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TECHNICAL MEMORANDUM NO. 3-331

FORECASTING TRAFFICABILITY OF SOILS

Report 9

WATER TABLE STUDY AT CROSSETT, ARKANSAS

by

J. R. Bassett

M. P. Meyer

July 1968

Sponsored by

U. S. Army Materiel Command

Conducted by

U. S. Army Engineer Waterways Experiment Station
CORPS OF ENGINEERS
Vicksburg, Mississippi

and

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ARMY-MRC VICKSBURG, MISS

FOREWORD

The study reported herein was designed to improve methods currently used to predict moisture contents of soils with high water tables. It is a part of Department of the Army Project 1-T-0-21701-A-046, "Trafficability and Mobility Research," Task 02, "Surface Mobility," sponsored by U. S. Army Materiel Command.

The study was performed by the Vicksburg Research Center, Forest Service, U. S. Department of Agriculture, in cooperation with the U. S. Army Engineer Waterways Experiment Station (WES) under the general supervision of Mr. W. J. Turnbull, Technical Assistant for Soils and Environmental Engineering; Mr. W. G. Shockley, Chief of the Mobility and Environmental Division, Mr. S. J. Knight, then Chief of the Army Mobility Research Branch, now Assistant Chief of the Mobility and Environmental Division; and Mr. A. A. Rula, then Chief of the Trafficability Section, now Chief of the Vehicle Studies Branch. Field studies were conducted during the period of November 1959 through February 1961. Dr. John R. Bassett was in charge of the field work for the Vicksburg Research Center, and Messrs. Robert Gordon and James A. Carter were his assistants. Mr. Charles A. Carlson of the WES developed the water table prediction method. This report was written by Dr. Bassett, formerly with the Forest Service and now on the faculty of the School of Natural Resources, University of Michigan, and Mr. Marvin P. Meyer, WES.

The authors are grateful to the Crossett Division of the Georgia-Pacific Corporation and to Mr. William Stover for use of their land in establishing test sites. Mr. Marvin Lawson, Senior Soil Correlator, Soil Conservation Service, Little Rock, Ark., identified the soils at most of the test sites. Mr. R. R. Reynolds, Project Leader of the Crossett

Timber Management Laboratory, Forest Service, assisted in many ways to facilitate field work.

Directors of the WES during conduct of the study and preparation of this report were COL Edmund H. Lang, CE, COL Alex G. Sutton, Jr., CE, and COL John R. Oswalt, Jr., CE. Technical Director was Mr. J. B. Tiffany.

CONTENTS

CONVERSION FACTORS, BRITISH TO METRIC UNITS OF MEASUREMENT

British units of measurement used in this report can be converted to metric units as follows:

Multiply	By	To Obtain
inches	2.54	centimeters
square inches	6.4516	square centimeters
feet	0.3048	meters
miles	1.609344	kilometers
pounds	0.45359237	kilograms
pounds per cubic foot	16.0185	kilograms per cubic meter
Fahrenheit degrees	5/9	Celsius or Kelvin degrees*

* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: $C = (5/9)(F - 32)$. To obtain Kelvin (K) readings, use: $K = (5/9)(F - 32) + 273.16$.

SUMMARY

The U. S. Army Engineer Waterways Experiment Station (WES) and Forest Service, U. S. Department of Agriculture, in previous studies, developed a method for predicting moisture content in the surface foot of soil. However, accuracy of prediction of soil moisture content was poor for soils with a high water table. The purpose of the study reported herein was to determine and evaluate soil, site, and weather factors that affect high water tables, and to explore means by which the WES moisture-prediction method could be modified to improve its accuracy when applied to soils with high water tables.

Factors considered to have a significant effect on the initiation, duration, and periodicity of high water tables were topographic position, depth of a relatively impermeable soil layer, precipitation, slope of ground, rate of evapotranspiration, and where applicable, stream or river stage.

Test sites were grouped according to topographic position because topography appeared to be the most important site factor affecting all aspects of water table conditions examined in this study. Within each group, the effects of precipitation and slope of ground on rise and fall of water tables were evaluated. Depth to water table was predicted daily with reasonable accuracy.

This study confirmed a previous observation that strengths of the 6- to 12-in. layer of soils with silt loam texture were at essentially constant minimum values when the depth to water table was less than 6 in. The accuracy of predicting moisture contents by means of the moisture-prediction method at sites with high water tables was improved by assuming that moisture contents remain at field maximum when depths to water tables are predicted to be less than 6 in. The accuracy of moisture content predictions was improved further by using special depletion rates during periods in the summer when depths to water tables were predicted to be less than 3 ft.

FORECASTING TRAFFICABILITY OF SOILS

WATER TABLE STUDY AT CROSSETT, ARKANSAS

PART I: INTRODUCTION

Background

1. Past investigations by the U. S. Army Engineer Waterways Experiment Station (WES) have shown that the trafficability of a soil is controlled largely by the strength of the surface foot of soil.[1] Since the strength of a given soil is affected primarily by its moisture content, studies were undertaken to develop methods for predicting changes in soil moisture content as a means of predicting soil trafficability for remote areas to which access is denied. The results of previous investigations conducted on this subject are given in a series of reports.[2]

2. Early soil moisture studies included data collected mainly at sites where an increase in moisture content was caused primarily by rainfall; however, during the later stages of the program, sites at which moisture content was influenced by the presence of a water table also were investigated. From soil moisture and rainfall data collected daily at each study site, accretion and depletion relations were developed to predict daily changes in soil moisture content. Soil wetting, or accretion, was related to the amount of daily rainfall and the storage available in the soil. The available storage is defined as the difference between the field-maximum moisture content and the amount of moisture currently in the surface foot of soil. Soil moisture loss, or depletion, which occurs as gravitational drainage and evapotranspiration, is expressed as a function of time between rains.

3. Comparison of accretion and depletion relations established for each site led to the development of average soil moisture prediction relations grouped by soil types, seasons, and rainfall amounts. Average prediction relations gave good results for sites on well-drained soils, but poor results for soils with high water tables.

4. The deficiencies in the average prediction relations when

applied to soils with high water tables were: (a) the field-maximum moisture contents were greater than those for well-drained soils, (b) the rates of soil moisture depletion were smaller and the durations of high moisture content were longer than those for well-drained soils, and (c) no means were available to predict the periodicity of high water tables (within 4 ft* of the surface) or their effect on the moisture content of the 6- to 12-in. soil layer. Consequently, it was recommended that further studies be made to evaluate the effects of the presence of high water tables on moisture contents of the 6- to 12-in. layer and to determine the factors that influence the occurrence, inception, periodicity, and duration of water tables in order to provide information needed to improve the accuracy of the moisture prediction method.

Purpose and Scope

5. The purposes of this study were to:

   a. Determine and evaluate the soil, site, and weather factors that affect significantly the inception, duration, and periodicity of seasonal high water tables.

   b. Establish water table-soil moisture relations and soil moisture soil strength relations for sites tested.

   c. Explore means by which the WES moisture-prediction method can be modified to improve its accuracy when applied to soils having high water tables.

6. This study was limited primarily to test sites on silt loam soils with seasonal high water tables. Sites were located in the vicinity of Crossett, Arkansas. The data were collected during the periods of November 1959 through June 1960 and November 1960 through February 1961.

Literature Survey

7. Prior to the beginning of the data-collection program, the literature was searched for information on factors that affect the occurrence, inception, duration, and periodicity of high water tables. Factors

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* A table of factors for converting British units of measurement to metric units is presented on page vii.

commonly listed were grouped into four categories: (a) weather, (b) soil, (c) vegetation, and (d) physiography. A brief summary of the pertinent findings of the literature survey for each category is given in the following paragraphs.

Weather factors

8. Precipitation and evapotranspiration. Precipitation and evapotranspiration directly affect the occurrence, inception, duration, and periodicity of high water tables. The effects of the amount and distribution of precipitation have been studied in bogs,[3] in forests,[4,5] and on fragipan soils.[6]

9. At the end of the growing season the soil begins to be recharged when cumulative precipitation exceeds evapotranspiration. From late autumn to early spring, when transpiration and evaporation are negligible, precipitation is the primary factor that affects inception and periodicity. When vegetation begins to remove appreciable quantities of water, duration of high water tables depends as much on evapotranspiration as on precipitation.

10. Atmospheric pressure. Atmospheric pressure affects periodicity, particularly levels of water in wells. Short-period fluctuations of water tables in irrigated soils have been attributed in part to the influence of atmospheric pressure on the volume of gaseous bubbles entrapped in the soil water. Peck[7] has shown that the maximum rate of change of water table height due to change of air pressure occurs when the water table is near the surface of the soil. Veatch[8] concluded that precipitation moving through soil, besides contributing soil water, can raise water in a well by compressing the air above the water table.

Soil factors

11. Relatively impermeable layer. A perched water table does not always occur above a relatively impermeable layer, but such a layer is a major causal factor where one does occur. Water percolates through the layer so slowly that gravitational water builds up on top of it. The depth of the layer affects the date of inception of a water table, i.e. the deeper the layer, the later the inception.

12. The difference in rates of permeability through the soil above

and within a relatively impermeable layer determines how fast gravitational water builds up above it. Hence, permeability of the layer affects duration and periodicity.

13. Texture and pore-size distribution. Texture and pore-size distribution affect soil permeability which in turn affects duration and periodicity. More important, texture and pore size largely determine the water-holding capacity of a soil, thus influencing its moisture content at various distances above a water table.

14. Baver[9] summarized the literature concerning retention and movement of soil moisture and concluded that upward movement of water by capillarity is not as great as earlier investigators believed. Some subsequent work suggests that water indeed may move to the surface from a water table at considerable depth, as much as 9 ft[10,11] to 30 ft.[12] The moisture content of the 0- to 9-in. layer of a silt loam soil in Mississippi was affected by a water table to a depth of at least 4 ft from January to July.[2c(2)]

15. Initial wetness of soil. In theory, relatively little water moves downward through soil under the force of gravity until all or most capillary-size pores are filled. Hence, wetness of the soil at the beginning of the season of recharge partially determines how soon gravitational water will contribute to the formation of a high water table.

16. Brasted[13] reviewed the literature concerning the distance that the capillary fringe extends above a water table and found that reported distances ranged from a few inches to 30 ft. He felt that this variation might well be explained in terms of the initial wetness of the soil above a water table.

17. Soil temperature. The periodicity of a high water table is affected by changes in soil temperature, which causes movement of water vapor and liquid water. Bouyoucos[14] demonstrated that soil moisture moved from a warm, moist area to a cold, dry area at a rate that increased with moisture content up to a point he termed the "thermal critical moisture content." At greater moisture contents thermal transfer slowed as moisture content increased. Smith[15] confirmed this work but felt that moisture migrated much faster than reported by Bouyoucos.

18. Moore[16] concluded that, under field conditions, rapid changes in soil temperature above a water table would be accompanied by rising water tables with rising temperature, and falling water tables with falling temperature. Meyer[17] followed daily fluctuations of high water tables in flat areas. He observed a water table rise of more than 12 in. when the temperature suddenly rose, although no precipitation reached the water table. This behavior tends to confirm Moore's conclusion.

19. During winter and spring Schneider[18] found that air temperatures were closely related to levels of a water table 4 to 6 ft below the ground surface. He attributed the winter decline of the water table in part to migration of moisture from the water table upward to frozen soil. As soil warmed in the spring, meltwater from frost percolated down to raise the water table.

20. Taylor and Cavazza[19] have shown that the flow of moisture in the soil from warm to cool regions might occur largely as vapor. Rollins[20] and Hutcheon[21] generally agree. Meyer,[17] on the other hand, believes that changes in water table levels caused by temperature changes observed in both the field and laboratory represent primarily a migration of liquid water over the surface of soil particles.

Vegetation factor

21. The presence or absence of stands of forest trees affects duration and periodicity of high water tables. Fletcher and McDermott[22] measured moisture depletion from a loessial soil underlain by a fragipan 20 to 40 in. below the ground surface. A water table persisted in areas where trees had been removed but disappeared during the growing season in forested areas. Wilde et al.[23] observed similar behavior of a water table in a glacial moraine soil underlain by an indurated subsoil. The water table rose at least 12 in. after trees were removed. Trousdell and Hoover[24] observed that within strips of forested land a water table receded during the growing season, but 33 ft or more away from the edge of the strips the water table was not lowered. Many investigators[25,26,27,28,29] have shown that in given areas different species of trees remove about the same amount of water from soil over the same period of the growing season.

Physiographic factors

22. Topographic position. Topographic position affects the inception, duration, and periodicity of high water tables. For example, surface and internal lateral drainage cause water tables to appear sooner at the bottom of slopes than at the top of slopes. Moreover, water tables fluctuate less and remain longer at the bottom of slopes.[6,30]

23. Steepness of slope. Slope affects rates of surface and internal lateral drainage, which in turn affect periodicity, inception, and duration of high water tables. Periodicity is affected because slope influences the rate at which water moves laterally to, through, or from a given area due to gravity. As slope increases, inception tends to be delayed and duration shortened at any point on the slope.

Definitions

24. Soil, soil moisture, and trafficability terms used in this report are defined below.

Soil terms

Bulk density. The dry unit weight of soil per unit volume expressed in grams per cubic centimeter. The volume of the soil sample is measured in its field condition, whereas its weight is measured after it has been dried to a constant weight at 105 C. Bulk density is synonymous with unit weight (dry); multiplied by 62.4, it is equal to the dry unit weight in pounds per cubic foot.

Fines, percent. The percentage by weight in a soil sample of particles that pass through a No. 200 U. S. standard sieve (0.074 mm).

Fragipan. A natural subsurface soil layer with high bulk density relative to the soil above, seemingly cemented when dry but showing a moderate to weak brittleness when moist. The layer is very low in organic matter content, is mottled, has a relatively low permeability to water, and usually contains a high content of silt and a relatively low content of clay.

Loess. A fine-grained eolian deposit composed dominantly of silt-size particles.

Mottling. Irregular patches of color different from that of the soil mass.

Permeability. The readiness with which water penetrates into or passes through soil pores.

Soil series. A group of soils with similar characteristics and arrangement of soil horizons in the soil profile, except for the texture of the surface or "A" horizon. The soils within a series are developed from a particular type of parent material within a specific climatic environment, and are essentially homogeneous with respect to such features as slope, stoniness, degree of erosion, topographic position, and depth to bedrock. The series names are names of places from the area where the soil was first defined, such as Miami, Hagerstown, Norfolk, and Houston.

Soil type. A subdivision of a soil series, based on the texture of the surface or "A" horizon, which is the zone of organic accumulation and/or eluviation (mineral leaching). The type-textural name follows the series name, i.e. Miami silt loam or Norfolk sandy loam.

Soil moisture terms

Evapotranspiration. The process whereby water is removed from the soil by vegetation and evaporation.

Field-maximum moisture content. The recurring maximum moisture content of a soil layer in its natural postion. This value, the highest point on the depletion curve, represents maximum wetting during the wet season of the period of daily record, usually one year.

Minimum-size storm. The smallest storm used in moisture prediction for a particular soil-vegetation condition. Smaller storms do not appreciably wet the soil, and depletion occurs.

Moisture tension. The force, or tension, by which water is held to the soil surface or within interstices; it varies inversely with the soil moisture content. The moisture content-tension relation for a particular soil is determined by means of a laboratory device at a sequence of tension, or pressure, settings. At a given moisture content, the tension is equal to the equivalent negative or gage pressure to which free water in the device has been subjected in order to be in hydraulic equilibrium, through a permeable wall or membrane, with the water in the soil.

Periodicity of water table. The cyclic fluctuation of the water table.

Pore space, total (theoretical maximum soil-moisture content). The total amount of voids (air and water) in a unit volume of soil in its natural structure.

Pore space, capillary. The portion of total pore space that can be filled with capillary water. Capillary water is held by surface tension forces, greater than the force of gravity, as a continuous film around the soil particles and in the capillary pore spaces.

Pore space, noncapillary. The portion of total pore space that will be drained of water under the force of gravity.

Pore space, small. That portion of the total pore space that will be drained of water as moisture tension increases from 0.06 to 15 atm.

Pore space, large. That portion of the total pore space that will be drained of water as moisture tension increases from 0 to 0.06 atm.

Soil-moisture content. The water content of soil expressed as a percentage of the weight of water driven off at 105 C to the weight of the remaining dry soil.

Water table. The upper surface of groundwater; the locus of points in soil water at which hydraulic pressure is equal to atmospheric pressure. In this study a "high" water table means a water table within 4 ft of the ground surface.

Water table, perched. The upper surface of a body of free groundwater in a zone of saturation separated by unsaturated material from an underlying body of groundwater.

WES moisture-prediction method. A method for predicting moisture content in the surface foot of soil in inches of water per 6 in. of soil, based on daily rainfall amount and knowledge of the following factors: field-maximum moisture content, field-minimum moisture content, accretion relations, depletion relations, minimum-size storm, and transition dates between seasons.

Wetness index. A numerical index expressing the effect of environmental conditions on the maximum moisture content in the 0- to 12-in. layer of soil. The degree of wetting is determined by the depth to a perched or

permanent water table, and the depth of penetration of water from precipitation. All test sites in this study had wetness indexes of 3 or 4, which indicates that the water table rose to within 1 to 4 ft or to within 0 to 1 ft, respectively, of the ground surface.

Trafficability terms

Cone index (CI). An index of the shearing resistance of soil obtained with a cone penetrometer.

Cone penetrometer. A field instrument consisting of a 30-deg cone with 1/2-sq-in. base area mounted on one end of a 36-in. shaft, and a proving ring with dial gage and handle mounted on the other. The force required to move the cone slowly through a plane of a given material is indicated on the dial inside the proving ring. This force is considered to be an index of the shearing resistance of the penetrated material in that plane. A capacity load of 150 lb deflects the ring 0.1 in. and gives a cone index reading of 300.

Critical layer. The soil layer that is regarded as being most pertinent to establishing relations between soil strength and vehicle performance. In clean sands, it is usually the 0- to 6-in. layer. In fine-grained soils and sands with fines, poorly drained, it is usually the 6- to 12-in. layer, but it may vary with vehicle weight and soil strength profile.

Remolding index (RI). A ratio that expresses the proportion of original strength that will be retained by a fine-grained soil or a sand with fines, poorly drained, after being subjected to vehicular traffic. The ratio is determined from cone penetrometer measurements made before and after remolding a soil sample using a special instrument and procedures. A remolding index less than 1.00 indicates a strength loss; a remolding index greater than 1.00 indicates a strength gain.

Rating cone index (RCI). The product of the measured cone index and remolding index for the same layer of soil.

Soil trafficability. The ability of a soil to permit the movement of a vehicle.

Trafficability sampler. A piston-type soil sampler for securing soft soil samples. Spacer bars permit trimming the sample to a known volume for density determinations.

PART II: TEST PROGRAM

Selection of Study Area

25. The Crossett Timber Management Laboratory (TML) of the Forest Service, located 6 miles south of Crossett, Ark., was used as a field headquarters. The following criteria were used to select a suitable study area: (a) variety of high water table conditions, (b) presence of soil types that when wet are critical from the trafficability standpoint, and (c) accessibility.

26. On the basis of the criteria above, Ashley County in southeast Arkansas was chosen as the study area. High water tables usually appear in midwinter and last until midspring throughout much of the county. Many soils normally become so weak during this period that logging operations off improved roads are limited to crawler-type tractors.

Description of Study Area

Physiographic divisions

27. The study area (see fig. 1) can be subdivided into three physiographic divisions: bottomlands and alluvial terraces, forested coastal plain, and loessial terraces.[31]

28. Bottomlands and alluvial terraces. The bottomlands and alluvial terraces consist of broad alluvial plains occupied by major streams. Elevations range from about 60 to 65 ft* in the bottomlands of the study area (west side of Ashley County).

29. Forested coastal plain. The forested coastal plain is flat to gently undulating. Most level areas occur adjacent to streams and drainageways and in the so-called "flatwoods" of the uplands. The more rolling topography occurs along the slopes between upland and bottomland areas. Elevations range from about 110 to 200 ft.

30. Loessial terraces. The loessial terraces comprise nearly

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* Elevations used herein are in feet referred to mean sea level.

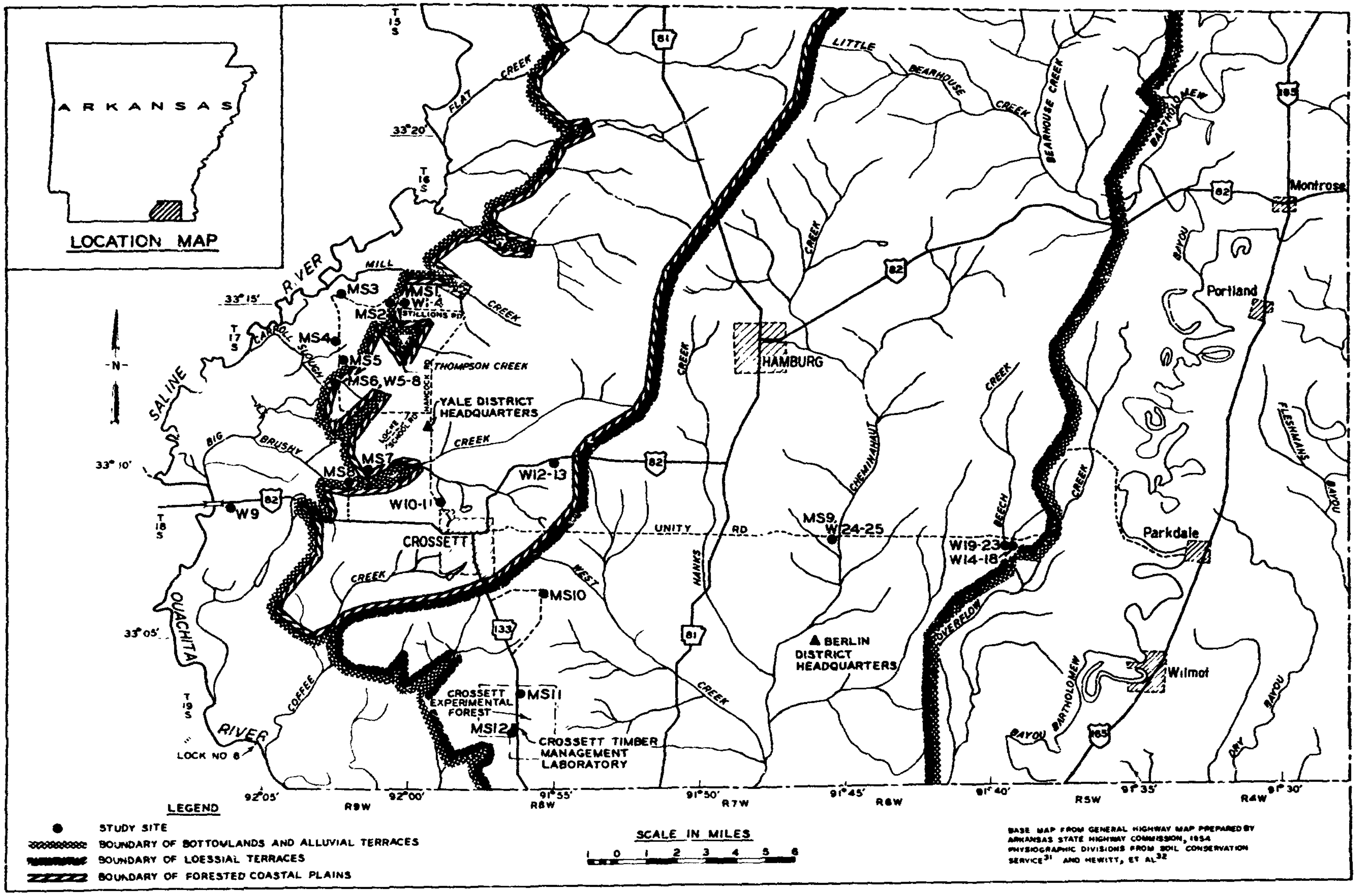


Fig. 1. Location of test sites, Ashley County, Arkansas

level areas capped by a loessial silt deposit. Elevations range from about 130 to 220 ft.

Streams

31. Streams in wide floodplains have a meandering drainage pattern; elsewhere the drainage pattern is dendritic (see fig. 1). Major streams in wide floodplains flow generally southward. Minor streams on the forested coastal plain flow generally westward into the Saline or Ouachita River. Minor streams on the loessial terraces flow generally southward into Cheminahaut Creek or Bayou Bartholomew. Watersheds are pear shaped and difficult to delineate because of the lack of sharp relief.

Soils

32. General. The surficial material of the study area, except for recent deposits along streams, consists of Pleistocene alluvium that ranges from a few feet to 200 ft in thickness.[32,33] Soils in the forested coastal plain, predominantly Red-Yellow Podzolics, are generally coarse textured, having been derived from unconsolidated sand and clay;[34,35] the permeability ranges from rapid to very slow. Soils in the bottomlands and alluvial terraces are deep and fine to coarse textured, and range in permeability from rapid to very slow. Soils of the loessial terraces are deep, medium textured, and slowly to very slowly permeable.

33. Fragipan and perched water table conditions. Underlying many soils at depths from about 6 to 40 in. are fragipans from about 10 to 36 in. thick. These soils normally begin to recharge and perched water tables begin to build up on top of the fragipans in late October or early November, when trees cease to transpire appreciably and evaporation becomes negligible. As the fragipans gradually become saturated, water begins to percolate through them very slowly or move laterally across them. Relatively little water passes through them. In the spring, evapotranspiration causes the perched water tables to disappear; amounts and distribution of rainfall and topographic positions largely determine the time of water table disappearance.

Climate

34. Mean annual temperature at the Crossett TML is about 64 F; extremes of -9 and 112 F have been recorded. Monthly means range from near

46 F in January to about 81 F in July and August. The average date of the last spring minimum of 32 F is 1 April; the average date of the first killing frost is 6 November. Mean annual rainfall is about 54 in. The monthly longtime average rainfall at the Crossett TML and the monthly rainfall for 1959-1960 and 1960-1961 at three locations are shown in the following tabulation.

	Rainfall, in.						
	Crossett TML*			Yale District Headquarters**		Berlin District Headquarters†	
Month	49-yr Avg	1959-1960	1960-1961	1959-1960	1960-1961	1959-1960	1960-1961
October	2.71	2.11	3.01	3.20	3.17	2.81	2.82
November	4.29	3.26	4.19	3.08	3.91	3.86	4.95
December	5.65	4.44	8.08	4.75	10.56	4.53	7.72
January	6.15	5.51	2.14	4.56	1.92	4.81	2.00
February	4.82	4.04	7.68	4.62	8.48	3.96	8.62
March	5.50	5.67	--	5.01	--	5.17	--
April	5.31	2.48	--	2.58	--	2.32	--
May	4.38	3.06	--	3.50	--	3.18	--
June	3.43	3.12	--	4.15	--	4.12	--
July	5.08	1.77	--	0.83	--	0.25	--
August	3.37	11.68	--	7.59	--	10.18	--
September	2.89	1.17	--	1.48	--	0.70	--
Total	53.58	48.31	--	45.35	--	45.89	--

* Sites MS10-MS12.
** Sites MS1-MS8 and W1-W13.
† Sites MS9 and W14-W25.

The locations of the three weather stations, Crossett TML, Yale District Headquarters (of Georgia-Pacific Corp., Crossett Division), and Berlin District Headquarters (of Georgia-Pacific Corp., Crossett Division), are shown in fig. 1.

Test Sites

35. Two types of test sites were established: moisture-strength and

well sites. The number, location, purpose, layout, and installation of sites are discussed in paragraphs 36-41.

Moisture-strength sites

36. Number, location, and purpose. Twelve moisture-strength sites (MS1-MS12) were established within 12 miles of Crossett (see fig. 1). Their locations are described in table 1. The purpose of these sites was to furnish data for evaluating how soil-moisture content and soil strength are related to each other and to depth of water table. Sites were established on relatively flat uplands, in bottomlands, and at the foot of slopes--places where water tables were presumed to occur within 4 ft of the surface. All sites were located in forested areas except one (MS10), which was located on a natural prairie.

37. Layout. Fig. 2 shows the layout of a moisture-strength site,

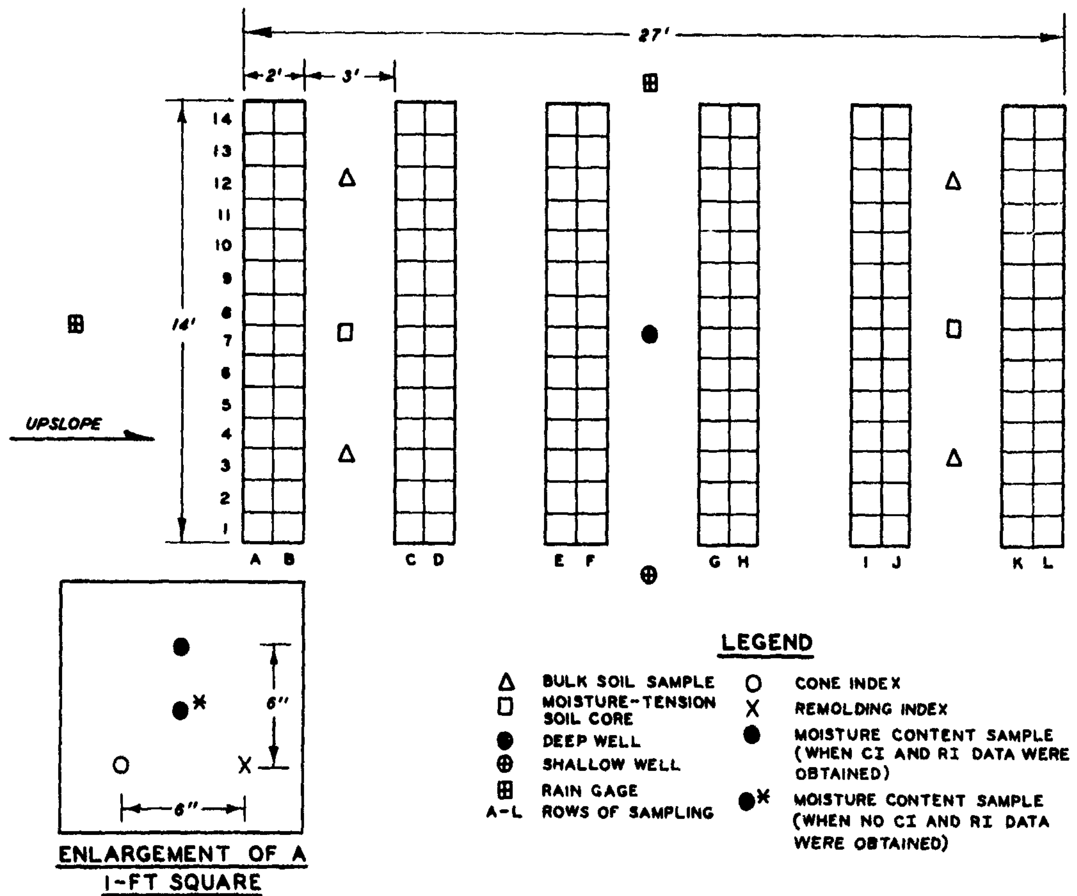


Fig. 2. Layout of a moisture-strength site

and the locations of wells, rain gages, and soil sampling and strength measurement points.

38. Installation of wells. Two wells, one deep and the other relatively shallow, were installed along the middle row at each site (see fig. 2). Deep wells were dug to a depth of from 4 to 4-1/2 ft, and shallow wells were dug to a depth of a few inches above or slightly below the top of a relatively impermeable layer. The depths of the wells and the dates on which they were installed are shown in table 2. The holes were dug with a 4-in.-diam, bucket-type auger and lined with a 4-in.-diam, galvanized iron downspout. The soil removed from each hole was used to seal the annular space around the casing. The lower foot of downspout was pierced with several small holes and the top was capped with aluminum foil. At the ground surface a mounded ring of soil was packed around the casing to prevent surface water from leaking into the well.

Well sites

39. Number, location, and purpose. Twenty-five well sites (W1-W25) were established, generally in forested areas along transects on upland flats or across a range of slope positions (see fig. 1). Their locations are described in table 1. Their purpose was to provide water table, moisture content, and strength data to supplement data collected from moisture-strength sites, and to provide additional data with which to evaluate the effects of soil and site factors on inception, duration, and periodicity of water tables.

40. Layout. The well served as the center of the site. Soil samples and strength data were collected about 5 ft from the well at the four cardinal compass points.

41. Installation of well. A well was dug at each site. Installation was similar to that of wells at moisture-strength sites (see paragraph 38). The depths of the wells and the dates on which they were installed are shown in table 2.

Data Collected

Site characteristics

42. Information collected at each site included elevation, landform

class, aspect, topographic position, slope, depth to a relatively impermeable soil layer, surface and internal drainage characteristics, wetness index, and vegetation (see table 3). Photographs and brief descriptions of some of the sites grouped by topographic position are presented in figs. 3-6. Fig. 7 illustrates a profile containing all topographic positions described in this study. The locations of sites on four sets of topographic profiles are diagrammed in fig. 8. Table 4 lists the locations and characteristic vegetation of the sites, grouped by topographic position.

Soil data

43. Data collected for each site include soil series, Unified Soil Classification System (USCS) and U. S. Department of Agriculture (USDA) soil classification, field moisture content, moisture contents at 0- and 0.06-atm tensions, dry density, specific gravity, total pore space, and soil strength. Moisture contents at 15-atm tension were determined only for moisture-strength sites.

44. Soil series. The 37 test sites were located on 20 different soil series. The profile and site characteristics for each soil series, grouped by parent material, are described in table 5. (Most of the soil series were identified by a senior soil correlator of the Soil Conservation Service.)

45. Bulk soil samples. Bulk soil samples were collected for purposes of USCS and USDA classification and determination of specific gravity and moisture content at 15-atm tension. Samples were obtained once at four points on each test site. At each point, bulk samples were taken in 6-in. increments from the ground surface to the depth of a relatively impermeable layer or to 4 ft if no impermeable layer was encountered. The four samples taken from the same 6-in. layer were combined to form one composite sample for that layer. A mechanical analysis was conducted on the composite sample for each layer, and Atterberg limits were determined for the 6- to 12-in. layer. The data were used to determine USDA soil texture and USCS soil class and to estimate the specific gravity of the soil. The bulk soil samples also were used to determine 15-atm tension values of the 0- to 6-in. and 6- to 12-in. layers for

a. Site MS10. Located on an upland flat underlain by a fragipan at a depth of about 27 in. Slope was about 1 percent. Vegetation consisted of prairie grasses

b. Site MS7. Located on an upland flat underlain by a fragipan at a depth of about 15 in. Slope was about 3 percent. Vegetal cover consisted largely of pine trees

c. Site W8. Located on an upland flat with a slope of about 2 percent. A short distance in the background, the slope changed abruptly to about 13 percent. Sites W5, W6, and W7 (not shown) were located at points downslope

Fig. 3. Upland flat sites

a. Sites W21 and W22. Site W22 was on a 12 percent slope, near the point where the upland flat began. Site W21 was further downslope. Forest vegetation consisted of pines and upland hardwoods

b. Sites W19 and W20. Site W20 was downslope from W21. Site W19 was near the foot of the slope, a few yards upslope from a shallow drainage ditch that ran parallel to the road

c. Sites W14 and W15. Site W15 was near the foot of a steep slope (up to 21 percent). Site W14 was in the channel of an intermittent drainageway. Vegetation consisted of upland hardwoods. Sites W16 and W17 (not shown) were further upslope (to the right)

Fig. 4. Slope and bottom of slope sites

a. Site MS8. Located on the floodplain of Big Brushy Creek. The man is standing on the bank of the creek, w[illegible]h is about 6 ft above the bottom of the creek. [illegible]ttomland hardwoods c[illegible]rised forest vegetation

b. Site MS9. Located on the floodplain of Cheminahaut Creek. The picture was taken from a bridge, looking down at the site across a 4-ft-deep drainage ditch running parallel to Unity Rd. Forest vegetation consisted of bottomland hardwoods

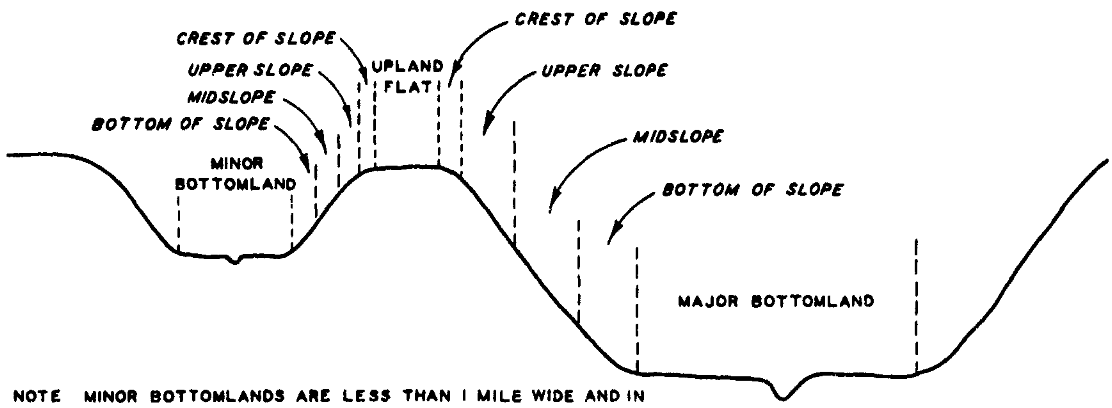
Fig. 5. Minor bottomland sites

a. Site MS3. Located in a small depression in a wide stream bottom subject to winter-long inundation from Saline River and Mill Creek overflow. Forest vegetation consisted of bottomland hardwoods. Ground cover was sparse

b. Site MS4. Located on a wide stream bottom subject to flooding from Carroll Slough overflow, which is about 200 ft south of the site (to the left). Bottomland hardwoods comprised forest vegetation. Ground cover was sparse

c. Site W9. Located on the floodplain of the Ouachita River, and subject to periodic inundation due to overflow of the river. Forest vegetation was comprised of shrubs and a few bottomland hardwoods. The ground was virtually bare of vegetation

Fig. 6. Major bottomland sites



NOTE MINOR BOTTOMLANDS ARE LESS THAN 1 MILE WIDE AND IN WATERSHEDS LESS THAN 100 SQ MILES IN AREA; MAJOR BOTTOMLANDS ARE WIDER AND IN LARGER WATERSHEDS.

Fig. 7. Topographic positions along a profile

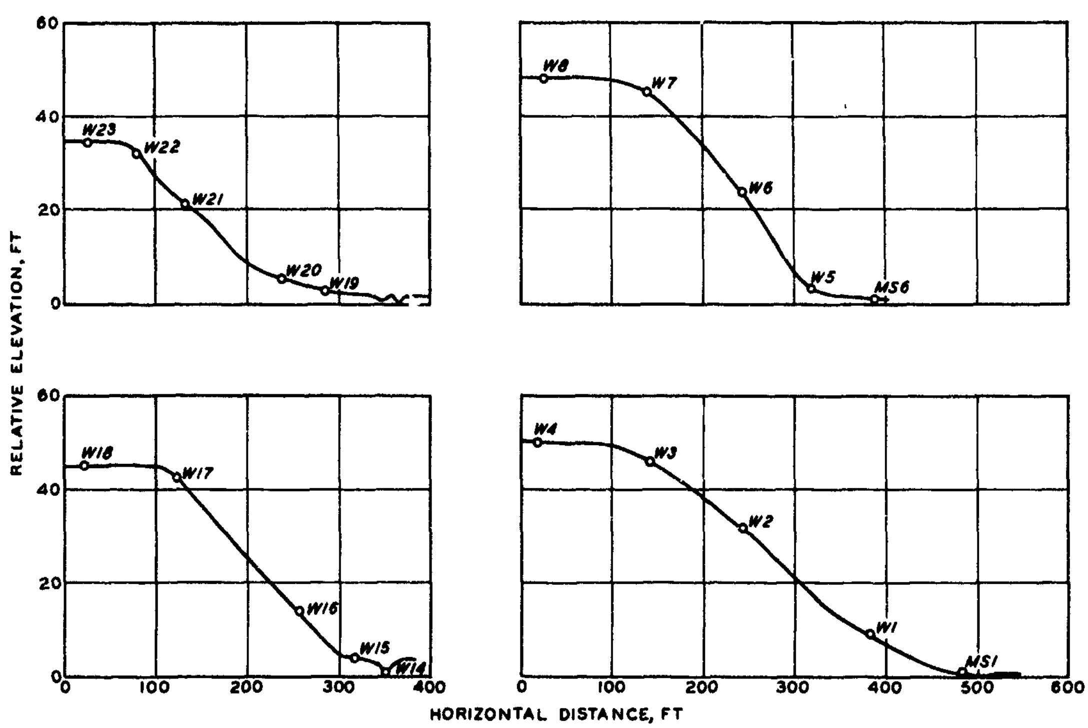


Fig. 8. Location of sites on four topographic profiles

moisture-strength sites only (see table 6). A pressure membrane apparatus[36] was used to determine the 15-atm tension values.

46. Moisture-tension samples. At each site one or two sets of four undisturbed cores, 2 in. in diameter and 1-3/8 in. long, were taken in 3-in. increments from the surface to a depth of 12 in. At some moisture-strength sites cores were taken from deeper depths, immediately above the top of the relatively impermeable layer. Cores were extracted with a modified San Dimas soil sampler[37] and placed on a tension table to determine moisture contents at 0- and 0.06-atm tension.[38,39] These sample cores also were used to determine density and total pore space. The data, averaged for a site in 6-in. layer increments, are presented in table 6.

47. Soil moisture samples. From December 1959 until water tables disappeared in June 1960, samples for determination of moisture content were collected at frequent intervals from the 0- to 6-in. and 6- to 12-in. layers at moisture-strength sites (see table 7). Samples for the determination of moisture content were collected from these same layers at well sites, but each well site was sampled only once during the week of 7-12 March 1960 (see table 8).

48. A trafficability sampler was used to obtain moisture-content samples in 6-in. increments. When the soil became too firm to sample with this tool, an Oakfield open-side punch was used.

49. Soil strength data. Cone index and remolding index measurements were taken periodically at moisture-strength sites between December 1959 and June 1960, and once at each well site during the week of 7-12 March 1960. For each visit, the rating cone index of the 6- to 12-in. layer was computed by multiplying the average of four cone indexes by the average of four remolding indexes. The data are presented in tables 7 and 8 for moisture-strength and well sites, respectively. The test procedures for obtaining cone index and remolding index are as follows:

a. Cone index. In each of four sampling squares, randomly selected, three sets of cone index readings were taken; each set included readings at the ground surface and depths of 3, 6, 9, 12, and 18 in. The three readings at the same depth were averaged. The cone index per visit for the 6- to 12-in. layer was the average of the cone

indexes from the four sampling squares for the 6, 9, and 12 in. depths.

b. Remolding index. In the same four sampling squares a remolding index test was made on one sample obtained from the 6- to 12-in. layer. The remolding index for a visit was the average of the four remolding indexes.

Rainfall measurements

50. Rainfall was measured at several points throughout the study area (see table 9). Measurements were taken daily at the Crossett TML and at two district forest offices of the Georgia-Pacific Corporation, Crossett Division (see paragraph 34). Rain gages placed on or near test sites were read each time the sites were visited. The total precipitation that accumulated between visits was portioned into individual storms using the daily record of the nearest office as a guide.

Water table measurements

51. Depths to water table were measured in deep and shallow wells during two periods: 16 November 1959 to 16 June 1960 and 23 November 1960 to 27 February 1961. Water table measurements were taken at intervals generally of one to three days. The data are summarized in tables 10 and 11 for moisture-strength and well sites, respectively.

PART III: ANALYSIS OF TEST RESULTS

52. This part of the report presents an analysis of those factors that affect the inception, duration, and periodicity of high water tables; presents a method for predicting water table levels; discusses the relations among water table level, soil moisture content, and soil strength; and shows how the WES moisture-prediction method can be modified to improve the accuracy of moisture prediction.

Inception of Water Tables

53. The two factors that most affected the inception of water tables were precipitation and topographic position.

Precipitation

54. Tables 12 and 13 list the dates on which water initially occurred at the bottom of the 4-ft wells and first rose to within 1 ft of the ground surface, respectively, at moisture-strength and well sites during the two periods 4 November 1959-16 June 1960 and 9 November 1960-27 February 1961. The tables also summarize cumulative rainfall after 1 October required to produce these water levels. 1 October was selected as the date on which to begin accumulating precipitation because, at Crossett, October is the month during which autumnal soil recharge normally begins.

55. Analysis of the data in tables 12 and 13 suggests that cumulative rainfall can be used to approximate the initiation of high water tables. For example, at site MS4 (see table 12) a water table appeared in the well during the first period (1959-60 wet season) on 10 December 1959, but it appeared as early as 15 November 1960 during the second period (1960-61 wet season). Although initiation of the water table varied by about one month between periods, approximately the same amount of cumulative rainfall (5.75 versus 5.80 in.) was required to produce the water table. However, at site MS4 the cumulative rainfall required for first occurrence within the surface foot was 8.45 in. and 6.85 in. for the two periods (see table 13). Cumulative rainfall necessary to initiate water tables in wells at all sites averaged 11.3 and 12.6 in. in the

1959-60 and 1960-61 wet seasons, respectively. For the first occurrence of water within the surface foot comparable averages are 13.1 in. and 14.3 in.

56. The factors of intensity and duration of rainfall have not been analyzed in this study, yet they can strongly affect initiation of water table under some conditions of drainage (surface and/or subsurface). Consider, for example, site W14 which lay in an intermittent drainageway (see fig. 4). During the 1960-61 wet season, 3.15 in. of rainfall over a two-day interval (see table 12) filled the drainageway and caused a water table to appear on 17 November 1960 after 7.70 in. of rain had fallen since 1 October 1960. During the 1959-60 wet season, no two-day rainfall of this magnitude occurred and a water table did not appear until 5 January 1960, following a 1.30-in. rain and cumulative rainfall of 11.30 in.

Topographic position

57. The cumulative rainfall data for each site shown in tables 12 and 13 have been grouped by topographic positions in tables 14 and 15, respectively. Cumulative amounts of rainfall required to initiate a water table differed greatly between sites in all topographic positions except bottomlands. Within the upland-flat position, for example, the mean cumulative rainfall necessary to initiate a water table was 3.85 in. at site MS11 but was 19.40 in. at site W11 (see table 14). In contrast, such differences were smaller at sites in major and minor bottomland positions; e.g. 9.90 in. at site MS9 versus 11.48 in. at site W25.

58. A comparison of mean cumulative rainfall values by topographic position (see table 14) clearly illustrates the strong influence of topography on the inception of high water tables. About three times as much cumulative rainfall was required to initiate water tables at sloping positions as in major bottomlands (16.65 in. versus 4.98 in.), and about twice as much at upland flats as in major bottomlands (10.01 in. versus 4.98 in.). Mean cumulative rainfall amounts required to raise water levels within the surface foot at slope positions, upland flats, and major bottomlands were 19.02, 12.53, and 6.87 in., respectively (see table 15).

Duration of Water Tables

59. Because high water tables are associated with low soil strength-poor trafficability conditions, it is important to know the duration of high water tables in order to know how long poor trafficability conditions will persist.

60. Duration of water tables in wells and within 1 ft of the surface is shown in plates 1 and 2, respectively. These plates also show rainfall as bar graphs. Duration between 4 November 1959 and 16 June 1960 (226 days) is expressed in both number of days and percentages of time $\left(\frac{\text{days}}{226} \times 100\right)$ that water tables were present. Sites with less than two days of water table were considered as zero percent duration. Data were not analyzed for the period 9 November 1960 through 27 February 1961 because the study was terminated before water tables disappeared in the spring of 1961.

61. Factors that influenced duration of high water tables include precipitation, topographic position, slope, and depth to a relatively impermeable layer.

Precipitation

62. Examination of the data in plates 1 and 2 shows a weak relation between rainfall occurrence and water table occurrence. Moreover, the heavier the rainfall, the longer water tables persisted. Hence, frequency and amount of rainfall each affected duration of water tables. Since all sites received more or less the same amounts of rainfall on the same days, differences in duration between sites must be caused in part by factors other than precipitation.

Topographic position

63. Table 16 summarizes and plate 3 illustrates by bar graphs the duration of water tables in the wells and within the surface foot for sites grouped by topographic position. In major bottomlands, water was present in wells an average of more than 90% of the time and was within 1 ft of the surface an average of more than 69% of the period. On slopes, comparable averages were 18%+ and 5%+. The average durations for the remaining topographic positions were intermediate.

Slope

64. The relation between percent slope and duration (not shown) was poor for upland-flat and slope positions. In the case of the latter, the poor relation may be attributed in part to average slope measurements; the slope often changed rapidly within short distances, but only the general slope over a long distance was measured.

65. At low-lying positions the slope changed gradually and could be related to duration of water tables in the well and within the surface foot as shown in plate 4. The data are listed in table 17 for sites grouped by units of percent slope. Site W15 was not included in the analysis because high water tables resulting from heavy rains were quickly dissipated by the rapid lateral movement of subsurface water from the site into an adjacent 3-ft-deep drainageway. Duration within the surface foot was significantly (0.01 level) related to slope. For each 1% increase in slope, duration decreased about 3.2%, or about seven days, of the study period. The relation between slope and duration of water table in the well was also significant (0.05 level). For each 1% increase in slope, duration decreased about 4.5%, or about 11 days, of the period.

Depth to relatively impermeable layer

66. The relation between depth to the relatively impermeable layer and duration was poor for bottomland and upland-flat sites. At these sites the depth to the top of the relatively impermeable layer was difficult to determine because the permeability of the soil decreased imperceptibly with depth, and the fragipans were relatively wet and soft when the wells were dug.

67. The relation between depth to fragipan and duration was much stronger on sloping sites. On slopes, the depth to a relatively impermeable layer was measured accurately because the change from a permeable to a relatively impermeable layer in the soil profile was relatively sharp. Table 18 lists depth to a relatively impermeable layer and average duration of the water within the surface foot for sites on slope positions. Plate 5 shows the linear regression for the data. The data for sites W3 and W6 were excluded from the analysis because the well at each of these sites penetrated the impermeable layer and the section of

perforated well casing abutted the impervious soil preventing free water in the overlying pervious soil from draining into the well. The relation in plate 5 was significant (0.05 level) and shows that for each 1-in. increase in depth to a relatively impermeable layer, duration within the surface foot decreased 1.1%, or about two days.

Periodicity of Water Tables

68. Four factors appreciably affected the periodicity of water tables; precipitation, evapotranspiration, topographic position, and river stage.

Precipitation and evapotranspiration

69. Rainfall constitutes the primary source of water needed to initiate and maintain most water tables. Plates 6-15 reveal that water tables at most moisture-strength and well sites rose quickly in response to local rainfall and fell between rains; the heavier the rainfall, the higher the water tables rose and the longer they persisted. Magnitude and frequency of precipitation obviously are the major factors affecting periodicity.

70. Evapotranspiration does not affect periodicity significantly during the winter because vegetation is dormant or dead and the rate of evaporation is low. In late spring and throughout summer, however, appreciable amounts of water are removed from the soil through evapotranspiration and most water tables disappear. At Crossett, appreciable quantities of water normally begin to be transpired and evaporated by mid-March (not until 29 March in 1960).

Topographic position

71. Topographic position determines whether the site contributes or receives internal and surface runoff water. Water tables on slope positions drain downslope and contribute water to low-lying positions. For example, at site W8, located on the crest of a slope (see fig. 3), water tables quickly rose in response to rainfall and then quickly fell as the water drained downslope, resulting in sharply fluctuating water tables

(see plate 11). However, at site MS6, located at the bottom of the same slope, the water table remained at the surface most of the study period (see plate 7) because of the appreciable amount of water draining into the area from the higher position.

River stage

72. Local precipitation had little effect on the periodic rise and fall of the water table at site W9. This site was located in a major bottomland about 1/2 mile from the main channel of the Ouachita River. As shown in plate 16, the level of the water table depended primarily upon the stage of the river which, in turn, depended upon the magnitude and frequency of rainfall many miles upstream from the site. Water table levels at test sites near small streams were strongly affected by local rainfall, e.g., sites MS2 and MS3 (plate 6), MS4 (plate 7), MS8 and MS9 (plate 8), and W14 (plate 13).

Prediction of High Water Table Levels

73. Prediction of high water table levels requires estimates of when a water table first appears above a relatively impermeable layer or at a depth of 4 ft, the amount it rises following a rain, and the rate at which it falls between rains. This section of the report presents a method for making these estimates, shows by example how the method is used to predict high water table levels, and indicates its reliability by comparing predicted with measured levels.

Initiation of water tables

74. Mean cumulative precipitation required to initiate water tables at different topographic positions are shown in table 14 as:

Topographic Position	Cumulative Rainfall from 1 October, in.
Upland-flat position	10.01
Slope positions	
Crest of slope	15.69
Upper slope	17.53
Midslope	16.72

(Continued)

Topographic Position	Cumulative Rainfall from 1 October, in.
Low-lying positions	
Bottom of slope	9.97
Minor bottomland	10.73
Major bottomland	4.98

75. In order to predict the specific day when a water table first occurs at the top of a relatively impermeable layer, or at a depth of 4 ft, the rainfall is cumulated, beginning on 1 October, until the total reaches the mean cumulative value listed above for its topographic position. For example, at site MS12, on an upland-flat position, cumulative rainfall reached 10.00 in. on 6 January 1960 (see table 9). On this date the water table is predicted to first occur at a depth of 30 in. (the depth to the relatively impermeable layer, see table 3).

Rise of water table

76. Theoretically, a water table does not appear at the top of a relatively impermeable layer, or at a depth of 4 ft, until all small pores fill with water down to this depth. Following its appearance, the amount a water table rises depends on the amount of precipitation and the amount of available storage space (occupied by air) provided by large and small pores. In this study, large-pore space was assumed to be equivalent to the space drained of water as moisture tension increases from 0 to 0.06 atm. Small-pore space was assumed to be equivalent to the space drained in the range between 0.06 to 15 atm.

77. In order to predict the amount of water table rise above an impervious layer or above a depth of 4 ft, knowledge is needed of the amount of precipitation, the amount of large-pore space in the soil, and an index, termed "effective rainfall index," that defines the proportion of total rainfall that is effective in raising the water table. An empirical equation using these parameters was developed to predict the amount of water table rise as follows:

$$\text{Rise of water table} = \frac{P \times ERI}{LPS}$$

where

P = precipitation, in.

ERI = effective rainfall index

LPS = large-pore space, in. per in. of soil

78. Large-pore space (LPS). An LPS value of 0.08 in. was used when the water table was below a depth of 20 in., and an LPS value of 0.04 in. was used when the water table was above a depth of 20 in. These values were derived empirically from the soil moisture-tension data shown in table 6.

79. Effective rainfall index (ERI). The ratios of available storage capacity of soil to cumulative rainfall required to initiate water in the well and in the surface foot were used to develop an effective rainfall index. The ERI and data used to derive the ERI for each topographic position are presented in table 19. The sources of data for each column are explained in the footnotes or subheadings of the table. The available storage capacities of the soil in small pores, column 3, and all pores, column 4, were determined from moisture-tension data shown in table 6. The moisture-tension data for each 6-in. layer at a site were used to determine the available storage capacity for that layer. Storage capacities for layers with no moisture-tension data were interpolated from values above and below the layer or were estimated from tension data of similar soils in this study. Data on available storage capacities for the layers from the surface to the depth of the relatively impermeable layer, or to a depth of 4 ft if the site had no impermeable layer, were then added to provide one value for small pores and another value for all pores for each site. Data for each storage capacity were averaged for all sites of a topographic position to provide the values shown in columns 3 and 4 of table 19.

80. The derivation of an ERI can be illustrated by examining the data for upland-flat sites. Water tables first appeared in wells when the average cumulative rainfall reached 10.01 in. (see column 1). Available storage capacity in small pores averaged 6.0 in. (see column 3). The ratio of the two values is 0.60 (6.0/10.01, see column 5). Similarly, the ratio of storage capacity of all pores, 8.2 in. (see column 4), to

cumulative rainfall to initiate a water table in the surface foot, 12.53 in. (see column 2), is 0.65 (8.2/12.53, see column 6). The fact that these two ratios were similar, as were the respective pairs of ratios for each of the other topographic positions, indicates that within each topographic position a given rainfall has the same effectiveness in raising the water table regardless of the level of the water prior to the rainfall. Because the two ratios for each topographic position indicate the same effectiveness in raising the water table they were averaged (see column 7).

81. Because sites on upland flats are assumed to receive and contribute relatively little internal or surface runoff, the average storage capacity-cumulative rainfall ratio (0.625, see column 7) was adjusted to unity (see column 8), and the average ratios for all the other topographic positions were adjusted proportionately. The adjusted value for each topographic position is the ERI for that position. The ERI's are empirical and obviously are not necessarily applicable elsewhere. Nevertheless, they provide a means for comparing the relative effectiveness of rainfall for raising water table levels at different topographic positions. Compared with upland-flat sites, for example, rainfall is 0.50 times as effective at midslope sites and 3.35 times as effective at major bottomland sites (see column 8).

82. Table 20 lists estimated rises of the water table, in inches, below and above a water table depth of 20 in. for given amounts of rainfall at each topographic position. The values were derived from the equation and assumptions presented in paragraphs 77 and 78. For example, at midslope sites 1.0 in. of rain is estimated to cause a water table below a depth of 20 in. to rise 6.2 in. (rise = P × ERI/LPS = 1 × 0.50/0.08), and a water table above a depth of 20 in. to rise 12.5 in. (rise = 1.0 × 0.50/0.04).

Recession of water tables

83. In table 21 mean daily drawdown of water in wells is summarized by months for sites grouped by topographic positions. These mean rates were derived from an analysis of drawdown rates for 10 periods from 2 to 13 days duration between 3 March 1960 through 15 June 1960 and

12 December 1960 through 15 February 1961.

Prediction of water
table levels at site MS2

84. Table 22 shows the bookkeeping scheme for predicting the depths to water table at site MS2, one of three major-bottomland sites studied. An average of 4.98 in. of cumulative rainfall from 1 October was needed to initiate a water table on these sites (see table 14). On 13 November 1959, 0.60 in. of rain fell (see table 9). Preceding this rain the cumulative rainfall from 1 October 1959 was 4.55 in. Therefore, of the 0.60 in. of rain only 0.43 in. (4.98 - 4.55) was needed to initiate the water table at a depth of 48 in. (no relatively impermeable layer was present within the surface 4 ft). The 0.17 in. of excess rainfall on 13 November (0.60 - 0.43) raised the water table 7.1 in. (interpolated from table 20) to a depth of 40.9 in. from the surface (see line 2 of table 22). Drawdown of the water table from 13 November to 26 November, prior to the rain, was 1.10 in. per day (see November drawdown rates, table 21) or 14.3 in. for the 13-day period. The water table fell from 40.9 in. to a depth greater than 48 in. In this scheme, however, 48 in. is assumed to be the maximum depth to which the water table may fall during the wet season. After the 0.30-in. rain on 26 November the water rose 12.6 in. from a depth of 48 in. to a depth of 35.4 in. (see line 3). The bookkeeping scheme of rise and fall is continued until 15 December, when the predicted water table depth was 8.1 in. On this date 0.80 in. of rainfall could have raised the water table 20.0+ in. (see table 20), but only 8.1 in. was needed to bring the water table to the surface. The excess water is assumed to be dissipated by surface runoff. At this site, the water table actually rose above the surface; however, for purposes of water table and moisture prediction the water level above the surface is meaningless and the highest level of water table is considered to be at the surface.

85. In table 22, the periods when the water table is above a depth of 6 in. are indicated by a double dagger. These are the periods when the unmodified WES moisture-prediction method becomes inoperative. The reader is reminded that hereinbefore only the matter of water table predictions

has been considered. Details of how the water table prediction method is used in conjunction with the moisture-prediction method to predict moisture contents of the 6- to 12-in. soil layer will be discussed in paragraphs 95-97.

Deviation between predicted and measured water table levels at moisture-strength sites

86. Table 23 shows the average deviations between measured and predicted water table levels for moisture-strength sites grouped by topographic position. Deviations at each site were averaged for two periods: when the water table was present above a depth of 48 in. or above a relatively impermeable soil layer, and when the water table was above a depth of 6 in. Data were analyzed for the period from November 1959 through June 1960. When estimated levels fluctuated between 6 and 48 in., deviations ranged from 2.3 to 8.8 in. and averaged 4.5 in. for all sites. When estimated levels were above a depth of 6 in. from the surface, deviations ranged from 0.9 to 9.1 in. and averaged 2.7 in. for all the sites.

Relations Between Water Table Level, Soil-Moisture Content, and Soil Strength

87. This section of the report discusses the relations between strength and moisture content of the 6- to 12-in. soil layer, and between moisture content of the 6- to 12-in. soil layer and water table level.

Relations between moisture content and strength

88. Analysis of data. Moisture content and strength data were obtained for each moisture-strength site during the period 14 December 1959 through 17 June 1960 (see table 7). The analysis was restricted to data for the 6- to 12-in. layer because this is the layer critical to trafficability for most military vehicles. No attempt was made to correlate strength with any soil property other than moisture content.

89. Moisture content versus CI, RCI, and RI for sites MS1-MS4, MS5-MS8, and MS9-MS12 is plotted in plates 17-19, respectively. The

curves for the plots of CI and RCI versus moisture content are estimated curves of best fit for the data. The curve relating moisture content to RI for each site was calculated from the equation RI = RCI/CI for a given moisture content, using values read from curves of RCI and CI.

90. Reliability of strength data. Table 24 summarizes the range of strength data plotted in plates 17-19 and shows that the average deviation of measured values from the curves of CI, RCI, and RI are 11, 11, and 0.06 units, respectively. Moisture-strength data collected from undisturbed soils normally scatter around the curve of best fit because factors other than moisture content affect soil strength. Compared with similar data collected from other natural soils,[40,41] the scatter in plates 17-19 is small.

91. Additional evidence was available to strengthen the belief that not only were these moisture-strength relations reliable, but that the WES method of measuring soil strength produces consistent results with time. In the spring of 1953 and winter of 1954 moisture-strength data were collected near Crossett by personnel of the Vicksburg Research Center as part of a series of studies designed to develop moisture accretion-depletion relations for various soils. Sites MS7, MS8, and MS10 were located at, and site MS11 near, sites tested by Vicksburg personnel in 1953-54. Plate 20 shows plots of the 1953-54 and 1959-60 data and illustrates the degree to which the strength data agree at comparable moisture contents. Agreement was good at site MS8. At site MS7, CI data collected in 1953-54 had a greater scatter than those in 1959-60. At sites MS10 and MS11, CI data agreed very closely, but RI values (and consequently RCI values) derived in the latter study were much larger at comparable moisture contents, probably because of the compaction and remolding of the soil caused by grazing of cattle subsequent to 1954.

Relations between soil moisture content and depth to water table

92. In the winter and spring of 1959-60, during periods of no rain, soil-moisture measurements were taken as water tables dropped. Most of these data were collected during the periods 29 March through 20 April and 6 through 20 May. The data were analyzed to derive linear regression

lines relating water table depth to moisture content of the 6- to 12-in. layer. The regressions for sites MS1-MS4 and MS6 and MS7 are shown in plate 21, and those for sites MS8 through MS12 are shown in plate 22. The regressions are estimated lines of best fit for data below a water table depth of 6 in. The lines were not extended above the 6-in. depth because the average moisture content of the 6- to 12-in. soil layer tended to remain relatively constant and at or very close to field maximum when the water table rose above a depth of 6 in. For some sites (MS2, MS4, and MS8), the moisture content increased; however, the moisture content of the 6- to 12-in. layer, for all practical purposes, can be assumed to remain constant because the strength of the soil remains low and varies insignificantly as the water table fluctuates above this depth, termed "critical depth."

93. In plates 21 and 22, December-February data tend to fall below the regression lines suggesting, first, that the moisture contents of the soils were less during early winter than during late winter and spring at comparable water table depths and, second, that soils attained their highest moisture contents during the latter period after water tables had remained at a high level for a substantial period of time.

Modification of the WES Moisture-Prediction Method

94. This section of the report suggests an approach for modifying the WES moisture-prediction method and indicates the extent to which the accuracy of predicting moisture contents can be improved using two slightly different modified prediction methods. Site MS2 is used to illustrate ideas presented.

Prediction by the WES method and modified WES methods

95. WES moisture-prediction method. Using the WES moisture-prediction method,[2e] moisture contents of the 6- to 12-in. soil layer at site MS2 were predicted for the period December 1959-June 1960. The study period is divided into three seasons--winter, spring, and summer--delineated by the transition dates for Crossett, Arkansas (see table F1,

reference 2d). Note that accuracy of predicting moisture contents by means of the WES method appears good during winter but poor during spring and summer. The mean deviations of predicted from measured values for the three seasons are 0.14, 0.50, and 0.80 in., respectively (see table 25).

96. Moisture-prediction method, modification I. Using procedures discussed in paragraph 84, water table depths were predicted for the same period as predictions of moisture content. In plate 23 note that during winter and spring, all measured and most predicted water table levels were above the critical depth (6 in.). Since moisture content of the 6- to 12-in. layer is at or close to field maximum when the water table is above the critical depth (see paragraph 92), the WES moisture-prediction method was modified (modification I) to include the effect of this high water table condition. During winter and spring the moisture content of the 6- to 12-in. soil layer was held constant at field maximum whenever the predicted water table was above a depth of 6 in. When the predicted water table fell below a depth of 6 in. and remained below this depth for one full day, the nonmodified WES method was resumed. In plate 23 note that the accuracy of predicting moisture contents by this method is much better during spring but no better during winter and only slightly better during summer than that of the nonmodified WES method. The mean deviations of moisture contents of the modification I method from measured moisture contents for the winter, spring, and summer seasons are 0.24, 0.08, and 0.70 in., respectively (see table 25).

97. Moisture-prediction method, modification II. To improve the accuracy of predicting moisture contents during summer, a second modification (modification II) was used. In this method, the modification I method is followed during winter and spring. The spring depletion rates are extended into the summer season and used until the water table falls below a depth of 36 in., at which time the summer depletion rates are used. A water table depth of 36 in. was chosen as the depth to switch depletion rates because studies[41,42,43,44] have shown that the influence of water table on the moisture regime of the surface soil (through capillary action) is negligible when the water table lies below this

depth. By using modification II method, deviations of predicted from measured moisture contents in the summer were reduced to 0.22 in. (see table 25). This suggests that a spring or special depletion rate should be used in summer when water tables are high enough to affect appreciably the depletion rate in the surface foot. Although this conclusion is based on analysis of only one site, examination of the other moisture-strength sites indicates that the accuracy of predicting moisture content would be improved by using this method.

Comparisons of measured and predicted rating cone indexes

98. Plate 23 shows measured RCI data and predicted RCI data based on moisture contents predicted by the WES, modification I, and modification II methods, respectively, for site MS2. The RCI remained relatively low throughout winter, and all predicted values approximate measured values. Only one strength measurement was obtained in the spring. It is assumed that if more measurements were taken they would show minimum values similar to those for winter because moisture contents were at field maximum when measured during that period. It may be postulated, therefore, that deviations between measured RCI and predicted RCI, based on moisture contents of the WES method, would be relatively large; whereas, deviations between measured and predicted values, based on moisture contents of modification I method, would be small (see plate 23). During summer, deviations between measured and predicted RCI averaged 20 RCI units using modification II moisture contents, and averaged 161 and 173 RCI units using moisture contents of modification I and WES methods, respectively (see table 25).

PART IV: CONCLUSIONS AND RECOMMENDATIONS

Conclusions

99. Conclusions drawn from the analyses in this report are:

a. Inception of high water tables was significantly affected by cumulative precipitation and topographic position. Approximately the same amount of cumulative precipitation from one year to the next, beginning 1 October, was required to produce a high water table at a site. (Paragraph 55 and table 12.) Compared to major bottomland positions, sloping positions required about three times and upland flats about two times as much rainfall to initiate a high water table. (Paragraph 58 and table 14.)

b. Duration of high water tables was affected by topographic position, slope, depth to relatively impermeable layer, and precipitation. During the study period, November through June, high water tables prevailed at least 90% of the time for major bottomlands, 58% for minor bottomlands and bottom-of-slope positions, 48% for upland flat positions, and 18% for midslope, upperslope, and crest-of-slope positions. (Paragraph 63 and table 16.) On low-lying positions, the duration of the high water tables decreased an average of 4.5% of the study period (11 days) for each 1% increase in slope. (Paragraph 65 and plate 4.) On slope positions, the duration of water tables within the surface foot decreased 1.1% of the study period (about 2 days) for each 1-in. increase in depth to a relatively impermeable layer. (Paragraph 67 and plate 5.)

c. Periodicity of high water tables was affected by topographic position, amount of precipitation, rate of evapotranspiration, and river stage. Sites on upland positions generally had sharply fluctuating water tables; whereas, water tables at sites on low-lying positions fluctuated little. (Paragraph 71 and plates 6-15.) Water tables rose quickly in response to local rainfall and fell between rains; the heavier the rainfall, the higher the water tables rose and the longer they persisted. (Paragraph 69 and plates 6-15.) In the winter, because vegetation was dormant or dead, the rate of evapotranspiration was low and did not significantly affect periodicity; in late spring, however, appreciable amounts of water were removed from the soil and most water tables disappeared. (Paragraph 70.) At one site adjacent to a large river, the level of the water table was dependent primarily upon the stage of the river, which, in turn was dependent upon the

magnitude and frequency of rainfall many miles upstream from the site. (Paragraph 72 and plate 16.)

d. It appeared possible to develop reasonably accurate methods for predicting water table levels based upon rainfall data and soil and topographic characteristics. (Paragraphs 73-83, 86.)

e. The moisture contents of the soils were less during early winter than they were during late winter and early spring at comparable water table depths; soils attained their highest moisture contents during the latter period after water tables remained at a high level for a substantial period of time. (Paragraph 93, and plates 21 and 22.)

f. Accuracy of predicting moisture contents by means of the WES moisture-prediction method can be improved by (1) assigning field maximum values to the moisture content during the winter and spring when water tables are predicted to be above depths of 6 in. and (2) using a spring or special moisture depletion rate during periods in the summer when water tables are above depths of 36 in. (Paragraphs 96 and 97, and plate 23.)

Recommendations

100. The following recommendations are offered for guidance in future studies:

a. The study should include a large number of sites with different soil textures located in several geographic areas under different climatic regimes. Data should be collected and carefully evaluated on factors that significantly influence high water tables and moisture content and strength of the surface soil. Sufficient data should be collected to provide statistically sound relations, making full use of all available data collected at sites previously established for other studies.

b. Special depletion relations should be developed for use in the modified moisture-prediction method during periods in the summer when a high water table is present.

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Table 1

Geographic Locations of Test Sites

Site No.	General Location: Lat North	Long. West	Section	Town-ship	Range	Specific Location
						Moisture-Strength Sites
MS1	$33^{\circ}15'$	$92^{\circ}00'$	SWSWNE11	17S	9W	4 ch N of Stillion Rd
MS2	$33^{\circ}15'$	$92^{\circ}00'$	SWNENW11	17S	9W	1 ch S of Stillion Rd
MS3	$33^{\circ}15'$	$92^{\circ}02'$	NENENW9	17S	9W	1-1/2 ch N of Stillion Rd
MS4	$33^{\circ}15'$	$90^{\circ}02'$	NENESW16	17S	9W	2 ch W of road
MS5	$33^{\circ}13'$	$92^{\circ}02'$	SWNWNE21	17S	9W	1 ch E of road; 1/3 mile N of tram; on mound
MS6	$33^{\circ}13'$	$90^{\circ}02'$	SESESW21	17S	9W	2 ch W of road, at foot of steep slope
MS7	$33^{\circ}10'$	$92^{\circ}01'$	NWNWNE10	18S	9W	3 ch W of Locke School Rd
MS8	$33^{\circ}09'$	$92^{\circ}02'$	NWNESE9	18S	9W	6 ch WSW of telephone pole F75, adjacent Locke School Rd; site lines 3/4 ch N of Brushy Creek
MS9	$33^{\circ}08'$	$91^{\circ}45'$	SESESE18	18S	6W	1-1/2 ch S of Unity Rd
MS10	$33^{\circ}06'$	$91^{\circ}55'$	NWNWNW34	18S	8W	2 ch SE of garage of Wm. Stover
MS11	$33^{\circ}06'$	$91^{\circ}56'$	SWNESW16	19S	8W	3 ch E of Hwy 133
MS12	$33^{\circ}02'$	$91^{\circ}56'$	SESWSW21	19S	8W	2 ch W of Crossett Res Ctr Hq yard
						Well Sites
W1	$33^{\circ}15'$	$91^{\circ}59'$	SESWNE11	17S	9W	5 ch N of Stillion Rd, at foot of slope
W2	$33^{\circ}15'$	$91^{\circ}59'$	SESWNE11	17S	9W	2-1/2 ch N of Stillion Rd, halfway up slope
W3	$33^{\circ}15'$	$92^{\circ}00'$	SESWNE11	17S	9W	2-1/2 ch N of Stillion Rd, at top of slope
W4	$33^{\circ}15'$	$92^{\circ}00'$	SESWNE11	17S	9W	1-1/2 ch N of Stillion Rd, in flatwoods
W5	$33^{\circ}13'$	$92^{\circ}02'$	SESESW21	17S	9W	7 ch W of road, at foot of slope
W6	$33^{\circ}13'$	$92^{\circ}02'$	SESESW21	17S	9W	3 ch W of road, halfway up slope
W7	$33^{\circ}13'$	$92^{\circ}02'$	NENENW28	17S	9W	2 ch W of road, at top of slope
W8	$33^{\circ}13'$	$92^{\circ}02'$	NENENW28	17S	9W	1 ch W of road, in flatwoods
W9	$33^{\circ}09'$	$92^{\circ}06'$	NESWNE14	18S	10W	1-1/2 ch S of parking area next to highway
W10	$33^{\circ}09'$	$91^{\circ}59'$	SENENE13	18S	9W	1-1/2 ch E of Hancock Rd, in clearing
W11	$33^{\circ}09'$	$91^{\circ}59'$	SENENE13	18S	9W	N of site W10, about 1/2 ch inside woods
W12	$33^{\circ}10'$	$91^{\circ}55'$	NENWSE3	18S	8W	About 0.2 mile S of Hwy 82, in clearing
W13	$33^{\circ}10'$	$91^{\circ}55'$	NENWSE3	18S	8W	N of site W12, about 1/2 ch inside woods
W14	$33^{\circ}08'$	$91^{\circ}39'$	NESENE19	18S	5W	2-1/2 ch S of Unity Rd at foot of slope, in bottom of drainage channel
W15	$33^{\circ}08'$	$91^{\circ}39'$	NESENE19	18S	5W	3 ch S of Unity Rd
W16	$33^{\circ}08'$	$91^{\circ}39'$	NESENE19	18S	5W	4 ch S of Unity Rd, halfway up slope
W17	$33^{\circ}08'$	$91^{\circ}39'$	NESENE19	18S	5W	6 ch S of Unity Rd, at top of slope
W18	$33^{\circ}08'$	$91^{\circ}39'$	NESENE19	18S	5W	7-1/2 ch S of Unity Rd, in flatwoods
W19	$33^{\circ}08'$	$91^{\circ}40'$	SENWNW19	18S	5W	1 ch S of Unity Rd, at foot of slope
W20	$33^{\circ}08'$	$91^{\circ}40'$	SENWNW19	18S	5W	2 ch S of Unity Rd, near foot of slope
W21	$33^{\circ}08'$	$91^{\circ}40'$	SENWNW19	18S	5W	3 ch S of Unity Rd, halfway up slope
W22	$33^{\circ}08'$	$91^{\circ}40'$	SENWNW19	18S	5W	3-1/2 ch S of Unity Rd, at top of slope
W23	$33^{\circ}08'$	$91^{\circ}40'$	SENWNW19	18S	5W	4 ch S of Unity Rd, in flatwoods
W24	$33^{\circ}08'$	$91^{\circ}45'$	SWSWS[illegible]	18S	6W	1 ch S of Unity Rd
W25	$33^{\circ}08'$	$91^{\circ}45'$	SESESE18	18S	[illegible]	2 ch S of Unity Rd

Table 2

Date of Installation and Depths of Wells

Moisture-Strength Sites				Well Sites		
		Depth of Well, in.				
Site No.	Date Well Dug	Shallow	Deep	Site No.	Date Well Dug	Depth of Well, in.
MS1	11/20/59	33	51	W1	1/19/60	30
MS2	11/20/59	21	50	W2	1/19/60	42
MS3	11/19/59	32	53	W3	1/19/60	18
MS4	11/17/59	18	51	W4	1/19/60	24
MS5	11/18/59	21	51	W5	1/18/60	40
MS6	11/18/59	35	51	W6	1/18/60	15
MS7	11/17/59	13	47	W7	1/18/60	26
MS8	11/17/59	14	48	W8	1/18/60	23
MS9	11/23/59	24	52	W9	11/17/59	52
MS10	12/14/59	27	53	W10	12/4/59	42
MS11	11/16/59	29	54	W11	12/4/59	42
MS12	11/16/59	30	48	W12	12/14/59	26
				W13	12/14/59	26
				W14	1/15/60	36
				W15	1/15/60	38
				W16	1/15/60	27
				W17	1/15/60	26
				W18	1/15/60	21
				W19	12/3/59	39
				W20	12/3/59	18
				W21	12/3/59	18
				W22	12/3/59	35
				W23	12/3/59	36
				W24	11/23/59	29
				W25	11/24/59	30

Table 3

Site Characteristics

Site No.	El ft	Engrg Conf Land-form*	Aspect	Topographic Position	Slope %	Depth to Relatively Imper-meable Layer, in.	Drainage Surface	Drainage Internal	Wet-ness Index	Vegetation
MS1	81	IIC1	NW	Bottom of slope	1	30	Poor	Poor	4	Pine forest
MS2	80	IIB1	Level	Major bottomland	0	None	Poor	Poor	4	Hardwood
MS3	75	IIB1	Level	Major bottomland	0	None	Poor	Poor	4	Hardwood
MS4	80	IIB1	Level	Major bottomland	0	None	Poor	Poor	4	Hardwood
MS5	85	IIC1	SW	Upland flat	5	25	Medium	Poor	3	Pine forest
MS6	81	IVC1	NW	Bottom of slope	1	30	Poor	Poor	4	Pine forest
MS7	100	IVC1	SW	Upland flat	3	15	Poor	Poor	4	Pine forest
MS8	90	IIB1	Level	Minor bottomland	0	None	Poor	Poor	4	Hardwood forest
MS9	126	IIB1	NE	Minor bottomland	1	23	Poor	Poor	4	Hardwood forest
MS10	175	IIC1	SW	Upland flat	1	27	Poor	Poor	4	Hayfield
MS11	175	IIIA2	Level	Upland flat	0	27	Poor	Poor	4	Pine forest
MS12	175	IIIA2	Level	Upland flat	0	30	Poor	Medium	4	Pine forest
W1	93	IVC1	NW	Bottom of slope	4	27	Good	Medium	4	Pine forest
W2	116	IVC1	NW	Middle of slope	17	None	Good	Good	3	Pine forest
W3	131	IVC1	NW	Upper slope	8	12	Good	Good	4	Pine forest
W4	135	IIIA2	Level	Crest of slope	1	36	Poor	Medium	4	Pine forest
W5	85	IVC1	NW	Bottom of slope	6	25	Good	Poor	4	Pine forest
W6	105	IVC1	NW	Midslope	20	6	Good	Poor	4	Pine forest
W7	125	IVC1	NW	Upper slope	13	None	Good	Medium	3	Pine forest
W8	128	IIIA2	NW	Crest of slope	2	30	Poor	Medium	4	Pine forest
W9	70	IIB1	Level	Major bottomland	0	None	Poor	Medium	4	Hardwood
W10	175	IIIA2	SE	Upland flat	1	24	Poor	Poor	4	Pine forest
W11	176	IIIA2	SE	Upland flat	1	36	Poor	Poor	4	Pine forest
W12	175	IIIA2	SE	Upland flat	1	26	Poor	Poor	4	Pine forest
W13	176	IIIA2	SE	Upland flat	1	26	Poor	Poor	4	Pine forest
W14	117	IIB1	N	Bottom of slope	2	None	Poor	Poor	4	Hardwood
W15	121	IIC1	N	Bottom of slope	8	38	Good	Medium	4	Hardwood
W16	130	IIC1	N	Midslope	24	27	Good	Medium	4	Hardwood
W17	160	IIIA1	N	Upper slope	10	24	Medium	Poor	4	Hardwood
W18	163	IIIA2	W	Crest of slope	1	21	Poor	Medium	4	Hardwood
W19	128	IIC1	NE	Bottom of slope	5	36	Medium	Medium	4	Pine forest
W20	132	IIC1	NE	Bottom of slope	11	18	Good	Medium	4	Pine forest
W21	145	IIC1	NE	Midslope	14	19	Good	Poor	4	Pine forest
W22	156	IIIA1	NE	Upper slope	12	25	Good	Poor	4	Pine forest
W23	159	IIIA2	NE	Crest of slope	3	35	Poor	Poor	4	Pine forest
W24	134	IIIA2	Level	Upland flat	0	29	Poor	Poor	4	Pine forest
W25	124	IIB1	Level	Major bottomland	0	30	Poor	Poor	4	Hardwood

* Classes are as follows:
IIB1, water deposited, floodplain-active, undifferentiated alluvium.
IIC1, water deposited, terrace, alluvial.
IIIA1, eolian, loess, hills.
IIIA2, eolian, loess, flat.
IVC1, residual, unconsolidated sediment, clay.

Table 4

Site Location and Vegetation

Topographic Position	Site No.	Site Location	Forest Vegetation
Upland flat	MS7, MS11, MS12; W11, W13, W24	On relatively flat forested area, covering several square miles	Heavily forested with loblolly and shortleaf pines and upland hardwoods such as red gum, hickories, southern red oak, white oak, post oak, and ironwood
	MS5	On top of 3- to 4-ft-high mound in forested flatwoods	
	W10, W12	In 4-acre clearings, about 200 ft from sites W11 and W13, respectively	Dense cover of pine seedlings, grasses, and weeds
	MS10	On small prairie	Prairie grasses
Crest of slope	W4, W8, W18, W23	On forested flatwoods, within 100 ft of steep slope separating forested coastal plain from bottomland and alluvial terrace	Similar to forested upland flat
Upper slope	W3, W7, W17, W22	On downside of steep slopes, within 100 ft of sites W4, W8, W18, and W23, respectively	
Midslope	W2, W6, W16, W21	About halfway down the slopes described above	
Bottom of slope	MS1, MS6; W1, W5, W15, W19, W20	On slopes described above, slightly downslope from the point where the degree of slope changes from relatively steep to relatively flat	Similar to forested upland flat
	W14	In shallow channel of a drainageway of a short, intermittent stream	Hardwoods such as those found at sites in minor bottomland
Minor bottomland	MS8, MS9; W25	In floodplain of creeks that flow during the wet season but are reduced to a series of shallow pools during the dry season	Hardwoods such as red gum, hickories, ironwood, white ash, willow oak, dogwood, American elm, blue beech, red maple, swamp white oak, and bitter pecan
Major bottomland	W9	In floodplain of the Ouachita River, whose stage near Crossett is determined largely by precipitation that falls many miles to the northwest	Tree cover limited to scattered May apple and willow oak; ground cover sparse
	MS2, MS3, MS4	In floodplain of perennial streams, subject to long inundation during the wet season	Hardwoods such as green ash, white ash, bald cypress, pin oak, willow, oak, and May apple

Table 5

Parent Material and Profile Characteristics of Soil Series

Parent Material	Profile Characteristics	Soil Series	Site No.
Coastal plain sediments	Weak horizonation; surface layer consists of more than 3 ft of sand	Lakeland	W2
	Strong horizonation; surface layer texture heavier than loamy sand		
	Texture of B horizon not heavier than sandy clay loam		
	Well drained; no fragipan	Ruston	W7
	Fragipan		
	Moderately well drained	Gilead	W1
	Poorly drained	Mashulaville	MS6, MS7
	Texture of B horizon clayey		
	Mottling throughout upper B horizon	Susquehanna	W5
	Little or no mottling in upper B horizon		
	Sandy clay subsoil	Shubuta	W3
	Heavy clay subsoil	Boswell	W6
Loess	Fragipan present; loess less than 4 ft thick	Providence	W8
	Fragipan present; loess more than 4 ft thick		
	Moderately well drained	Grenada	MS12; W4, W10, W11, W17, W18, W22, W23, W24
	Somewhat poorly drained	Calloway	MS11; W12, W13
Alluvium	Alluvium washed from loessial soils		
	Deposited on stream terraces	Lintonia	W15, W16
	Deposited on floodplains		
	Somewhat poorly drained	Falaya	MS8
	Poorly drained	Waverly	MS9; W25
	Alluvium washed from coastal plain soils		
	Deposited on floodplains		
	Subsoil usually not heavier in texture than sandy clay loam	Bibb	W9
	Subsoil usually heavier than sandy clay loam	Chastain	MS2, MS3, MS4
	Deposited on stream terraces		
	Fragipan present	Myatt	MS1
	Fragipan not present		
	From thick unstratified deposits		
	Forest vegetation	Hortman	W21
	Prairie vegetation	Midland	MS10
	From thin stratified deposits		
	Heavy textured subsoil; moderately well drained	Izagora	MS5
	Subsoil not heavy in texture; well drained	Cahaba	W20
	Undifferentiated alluvium		W14, W19

Table 6

Physical Properties of Soils at Test Sites

Site No	Soil Series	Depth of Layer in.	USDA Text. Class.	USDA Texture by Wt, % Sand	Silt	Clay	USCS Soil Class.	USCS Fines %	Atterberg Limits LL	PL	PI	Bulk Density g/cc	Dry Density p f	Moisture Content, %, at Atm of Tension Zero	0.06	15.0	Specific Gravity*	Total Pore Space in./6 in.
MS1	Myatt silt loam	0-6	SiL	20	68	12		87				1.37	85.5	28.8	26.6	5.5	2.69	2.95
		6-12	SiL	20	68	12	CL-ML	89	26	21	5	1.47	91.7	25.3	23.1	5.4	2.69	2.72
		12-18	SiL	20	66	14		89				1.51	94.2				2.69	2.63
		18-24	SiL	18	64	18		89				1.53	95.5				2.69	2.59
		24-30	SiL	15	62	23		91				1.60	99.8				2.70	2.44
		30-36	SiL	18	59	23		88				1.54	96.1				2.70	2.57
		36-42	SiL	19	56	25		89									2.70	
		42-48	SiL	22	53	25		86									2.70	
MS2	Chastain silt loam	0-6	SiL	30	52	18		78				1.25	78.0	40.1	30.7	7.6	2.69	3.21
		6-12	SiL	24	57	19	CL	82	28	19	9	1.38	86.1	31.2	27.9	7.3	2.70	2.93
		12-18	SiL	24	54	22		81				1.44	89.9				2.70	2.80
		18-24	SiL	25	51	24		82				1.50	93.6		26.1		2.70	2.67
		24-30	CL	21	45	34		86									2.70	
		30-36	SiCL	18	47	35		88									2.70	
		36-42	SiCL	19	49	32		87									2.70	
		42-48	SiCL	19	43	38		88									2.70	
MS3	Chastain silt loam	0-6	SiL	30	51	19		82				1.35	84.2	36.1	33.4	6.5	2.68	2.98
		6-12	L	49	38	13	CL	60	24	16	8	1.51	94.2	21.9	19.9	6.5	2.67	2.61
		12-18	L	40	42	18		69				1.52	94.8				2.68	2.60
		18-24	L	39	39	22		69				1.52	94.8		21.9		2.68	2.60
		24-30	L	41	38	21		68				1.55	96.7				2.68	2.54
		30-36	CL	34	38	28		74									2.68	
		36-42	L	37	38	25		71				1.57	98.0		23.5		2.68	2.48
		42-48	L	38	37	25		69									2.68	
MS4	Chastain silty clay loam	0-6	SiCL	13	53	34		92				1.20	74.9	44.8	40.4	16.7	2.71	3.34
		6-12	SiCL	14	57	29	CL	94	35	18	17	1.41	88.0	31.4	30.2	11.3	2.71	2.88
		12-18	SiCL	10	51	39		95				1.36	84.9		32.4		2.71	3.10
		18-24	SiCL	12	55	33		95				1.42	88.6		25.2		2.71	2.86
		24-30	SiL	14	60	26		93									2.71	
		30-36	SiCL	11	59	30		47									2.71	
		36-42	SiCL	11	59	30		95									2.71	
		42-48	SiCL	11	55	34		52									2.71	
MS5	Izagora silt loam, mounded	0-6	SiL	40	52	8		68				1.33	83.0	29.4	24.8	5.4	2.68	3.02
		6-12	L	38	48	14	CL	69	25	17	8	1.60	99.8	26 9	24.6	6.6	2.68	2.42
		12-18	L	29	48	23		78				1.54	96.1		23.5		2.69	2.57
		18-24	CL	24	47	29		83									2.69	
		24-30	CL	21	42	37		86									2.69	
		30-36	CL	20	44	36		88									2.69	
		36-42	CL	39	33	28		71									2.69	
		42-48	SCL	51	26	23		58									2.68	
MS6	Mashulaville very fine sandy loam (tentative series)	0-6	SL	60	35	5		44				1.58	98.6	22.5	19.0	3.8	2.67	2.45
		6-12	SL	58	37	5	SM	47	12	13	-1	1.71	106.7	19.0	17.0	2.9	2.67	2.16
		12-18	SL	58	35	7		47				1.78	111.1				2.67	2.00
		18-24	SL	57	[illegible]	8		46				1.72	107.3				2.67	2.13
		24-30	SL	53	36	11		52				1.76	109.8		14.2		2.67	2.04
		30-36	SL	58	31	11		48				1.80	112.3		13.4		2.67	1.95
		36-42	SL	55	30	15		50									2.67	
		42-48	L	47	32	21		57									2.65	
MS7	Mashulaville silt loam (tentative series)	0-6	SiL	39	56	5		64				1.44	89.9	28.3	24.7	3.7	2.67	2.76
		6-12	SiL	40	55	5	ML	69	17**	16	1	1.46	91.1	24.4	21.3	2.7	2.67	2.72
		12-18	SiL	39	53	[illegible]		70									2.67	
		18-24	SiL	36	53	11		72									2.67	
		24-30	L	38	50	12		72									2.67	
		30-36	L	34	49	17		74									2.67	
		36-42	L	38	46	16		71									2.67	
		42-48	L	[illegible]	[illegible]	18		76									2.67	
MS8	Falaya silt loam	0-6	SiL	13	70	17		93				1.22	76.1	43.3	38.2	9.4	2.69	3.28
		6-12	SiL	14	67	19	CL	92	34	22	12	1.36	84.9	37.4	34.3	8.0	2.70	2.98
		12-18	SiL	15	67	18		93				1.47	91.7		28.2		2.70	2.73
		18-24	SiL	15	68	17		90				1.52	94.8				2.70	2.62
		24-30	SiL	14	62	24		91				1.56	97.3				2.70	2.53
		30-36	SiL	18	58	24		88				1.58	98.6				2.70	2.49
		36-42	SiL	20	57	23		88									2.70	
		42-48	SiL	20	56	24		87									2.70	
MS9	Waverly silt loam	0-6	SiL	19	57	24		88				1.16	72.4	46.7	36.7	14.0	2.69	3.41
		6-12	SiL	18	56	26	CL	89	35	21	14	1.37	85.5	40.6	32.1	11.4	2.70	2.96
		12-18	SiL	20	57	23		88				1.47	91.7				2.70	2.73
		18-24	SiL	19	58	23		90				1.50	93.6				2.70	2.67
		24-30	SiL	17	60	23		91				1.55	96.7				2.70	2.56
		30-36	SiL	17	57	26		91				1.58	98.6				2.70	2.49
		36-42	SiCL	15	57	28		92									2.70	
		42-48	SiCL	16	56	28		92									2.70	

(Continued)

* Estimated from hydrometer analysis.
** Determined with Foster tool.

Table 6 (Continued)

Site No.	Soil Series	Depth of Layer in.	USDA Text. Class.	USDA Texture by Wt, % Sand	Silt	Clay	USCS Soil Class.	USCS Fines %	Atterberg Limits LL	PL	PI	Bulk Density g/cc	Dry Density pcf	Moisture Content, %, at Atm of Tension Zero	0.06	15.0	Specific Gravity	Total Pore Space in./6 in.
MS10	Midland silt	0-6	SiL	14	74	12		96				1.32	82.4	36.8	33.7	5.6	2.71	3.08
	loam, thick	6-12	SiL	12	74	14	CL-ML	96	28	22	6	1.41	88.0	31.2	28.4	5.6	2.71	2.88
	surface	12-18	SiL	14	73	13		96				1.48	92.3				2.71	2.72
		18-24	SiL	13	73	14		96				1.49	93.0				2.71	2.70
		24-30	SiL	14	74	12		97				1.54	96.1				2.71	2.59
		30-36	SiL	13	71	16		96				1.54	96.1				2.71	2.59
		36-42	SiL	14	64	22		95									2.71	
		42-48	SiL	13	69	18		96									2.71	
MS11	Calloway silt	0-6	SiL	23	67	10		89				1.41	88.0	29.7	27.0	5.3	2.68	2.84
	loam	6-12	SiL	19	67	14	CL	91	29	21	8	1.47	91.7	27.2	25.1	6.2	2.69	2.72
		12-18	SiL	19	65	16		90				1.53	95.5				2.69	2.59
		18-24	SiL	21	64	15		91				1.55	96.7		24.3		2.69	2.54
		24-30	SiL	20	62	18		91				1.58	98.6		24.9		2.69	2.48
		30-36	SiL	22	60	18		89				1.56	97.3		16.7		2.69	2.52
		36-42	SiL	21	62	17		90									2.69	
		42-48	SiL	20	63	17		92									2.69	
MS12	Grenada silt	0-6	SiL	22	69	9		87				1.37	85.5	30.4	27.6	5.8	2.68	2.94
	loam	6-12	SiL	20	65	15	CL	90	27	19	8	1.49	93.0	27.2	24.2	5.5	2.69	2.68
		12-18	SiL	21	64	15		90				1.54	96.1				2.69	2.56
		18-24	SiL	20	63	17		92				1.56	97.3		26.1		2.69	2.52
		24-30	SiL	19	63	18		91				1.56	97.3		23.7		2.69	2.52
		30-36	SiL	18	62	20		90				1.57	98.0		23.1		2.69	2.50
		36-42	SiL	20	64	16		90									2.69	
		42-48	SiL	19	63	18		90									2.69	
W1	Gilead sandy	0-6	SL	73	16	11		32				1.47	91.7	26.8	18.4		2.66	2.68
	loam	6-12	SL	73	17	10	SM	29	Nonplastic			1.58	98.6	24.0	16.9		2.66	2.44
		12-18	SL	74	16	10		32									2.66	
		18-24	SL	67	18	15		37									2.66	
		24-30	SL	64	17	19		42									2.66	
W2	Lakeland loamy	0-6	SL	75	18	7		24				1.45	90.5	29.8	18.4		2.66	2.73
	fine sand;	6-12	LS	80	15	5	SM	24	Nonplastic			1.66	103.4	20.5	13.8		2.66	2.26
	moderately	12-18	LS	81	15	4		24									2.66	
	shallow to	18-24	LS	80	15	5		22									2.66	
	gravel	24-30	LS	81	13	6		21									2.66	
		30-36	LS	84	11	5		18									2.66	
		36-42	LS	84	11	5		17									2.66	
W3	Shubuta fine	0-6	L	51	39	10		57				1.42	88.6	30.4	25.5		2.67	2.81
	sandy loam	6-12	SL	53	40	7	ML	58	17	15	2	1.61	100.5	21.1	19.4		2.67	2.38
		12-18	L	37	40	23		50									2.67	
W4	Grenada silt	0-6	SiL	30	58	12		74				1.44	89.9	34.0	28.6		2.67	2.76
	loam	6-12	SiL	31	52	17	CL-ML	76	23	17	6	1.55	96.7	24.8	22.9		2.67	2.52
		12-18	SiL	26	52	22		79									2.67	
		18-24	SiL	26	51	23		79									2.67	
W5	Susquehanna fine	0-6	SL	61	29	10		44				1.60	99.8	24.4	16.7		2.67	2.40
	sandy loam,	6-12	SL	57	32	11	ML	48	16	13	3	1.71	106.7	20.2	16.2		2.67	2.16
	thick surface	12-18	SL	54	29	17		51									2.67	
		18-24	L	47	29	24		58									2.67	
		24-30	L	43	33	24		61									2.65	
		30-36	L	45	28	27		62									2.67	
		36-42	CL	40	30	30		64									2.67	
W6	Boswell gravelly	0-6	SL	67	21	12		34				1.56	97.3	24.0	18.2		2.67	2.49
	fine sandy	6-12	SCL	52	21	27	CL	53	36	16	20	1.65	103.0	22.1	18.4		2.67	2.29
	loam	12-18	CL	34	38	28		71									2.68	
W7	Ruston fine	0-6	SL	56	36	8		46				1.35	84.2	33.5	24.4		2.67	2.97
	sandy loam	6-12	SL	54	36	10	ML	51	14	13	1	1.66	103.6	19.4	17.0		2.66	2.25
		12-18	L	50	37	13		54									2.67	
		18-24	L	49	30	21		55									2.67	
		24-30	L	50	28	22		46									2.67	
W8	Providence silt	0-6	SiL	32	56	12		72				1.47	91.7	28.5	24.5		2.70	2.73
	loam	6-12	SiL	29	56	15	CL-ML	76	21	17	4	1.60	99.8	22.0	20.4		2.70	2.44
		12-18	L	25	49	26		81									2.70	
		18-24	L	25	50	25		81									2.70	
W9	Bibb loam	0-6	L	42	41	17		67				1.36	84.9	31.9	28.6		2.68	2.96
		6-12	L	51	32	17	CL	61	29	16	13	1.42	88.6	31.0	27.2		2.68	2.82
		12-18	CL	41	29	30		66									2.69	
		18-24	L	46	31	23		64									2.68	
		24-30	L	45	32	23		64									2.67	
		30-36	L	45	37	18		62									2.68	
		36-42	SL	60	24	16		49									2.67	
		42-48	LS	81	9	10		24									2.67	
W10	Grenada silt	0-6	SiL	22	65	13		89				1.41	88.0	30.6	27.0		2.70	2.87
	loam	6-12	SiL	22	59	19	CL	89	31	19	12	1.48	92.4	28.7	26.8		2.70	2.71
		12-18	SiL	19	61	20		91									2.70	
		18-24	SiL	22	56	22		90									2.70	
		24-30	SiL	25	54	21		88									2.70	
		30-36	L	26	49	25		87									2.70	
		36-42	SiL	22	57	21		90									2.70	

(Continued)

Table 5 (Continued)

Site No.	Soil Series	Depth of Layer in.	USDA Text. Class.	USDA Texture by Wt, % Sand	Silt	Clay	USCS Soil Class.	Fines %	Atterberg Limits LL	PL	PI	Bulk Density g/cc	Dry Density pcf	Moisture Content, %, at Atm of Tension Zero	0.06	15.0	Specific Gravity	Total Pore Space in./6 in.
W11	Grenada silt	0-6	SiL	20	72	8		90				1.33	83.0	37.0	33.2		2.70	3.04
	loam	6-12	SiL	19	[illegible]	13	CL-ML	90	25	18	7	1.50	93.6	27.4	24.7		2.70	2.67
		12-18	SiL	20	63	17		90									2.70	
		18-24	SiL	19	63	18		90									2.70	
		24-30	SiL	22	58	20		88									2.70	
		30-36	SiL	19	59	22		90									2.70	
		36-42	SiCL	16	56	28		89									2.70	
W12	Calloway silt	0-6	SiL	18	70	12		92				1.52	94.9	26.1	24.0		2.71	2.63
	loam	6-12	SiL	17	68	15	CL	91	29	20	9	1.44	96.1	26.8	24.7		2.71	2.59
		12-18	SiL	18	66	16		94									2.71	
		18-24	SiL	16	65	19		94									2.71	
		24-30	SiL	16	65	19		94									2.71	
W13	Calloway silt	0-6	SiL	17	70	13		93				1.40	87.4	31.3	29.0		2.71	2.90
	loam	6-12	SiL	16	69	15	CL-ML	93	27	21	6	1.44	89.9	30.6	27.6		2.71	2.81
		12-18	SiL	15	69	16		94									2.71	
		18-24	SiL	15	67	18		94									2.71	
		24-30	SiL	14	64	22		95									2.71	
W14	Undifferentiated	0-6	SiL	24	63	13		82				1.07	66.8	51.6	46.9		2.70	3.62
	alluvium	6-12	SiL	24	61	15	CL	81	33	23	10	1.21	75.5	41.8	38.0		2.70	3.31
		12-18	SiL	18	63	19		91									2.68	
		18-24	SiL	19	67	14		91									2.68	
		24-30	SiL	18	66	16		92									2.68	
		30-36	SiL	29	57	14		78									2.68	
W15	Lintonia silt	0-6	SiL	21	72	7		88				1.19	74.3	46.2	38.9		2.68	3.34
	loam	6-12	SiL	14	71	15	CL-ML	92	28	22	6	1.36	84.9	35.3	31.7		2.70	2.98
		12-18	SiL	19	67	14		91									2.68	
		18-24	SiL	16	66	18		90									2.70	
		24-30	SiL	17	71	12		91									2.68	
		30-36	SiL	15	72	13		92									2.70	
		36-42	SiL	15	68	17		93									2.68	
W16	Lintonia silt	0-6	SiL	19	67	14		90				1.40	87.4	32.8	30.4		2.70	2.89
	loam	6-12	SiL	17	64	19	CL	95	29	19	10	1.52	94.8	26.9	25.0		2.70	2.62
		12-18	SiL	20	63	17		91									2.68	
		18-24	SiL	16	62	22		91									2.70	
		24-30	SiL	18	61	21		92									2.68	
W17	Grenada silt	0-6	SiL	11	75	14		96				1.28	79.9	37.5	34.0		2.70	3.16
	loam	6-12	SiL	8	69	23	CL	97	33	20	13	1.33	83.0	31.9	30.6		2.70	3.04
		12-18	SiL	9	68	23		97									2.70	
		18-24	SiL	12	67	21		97									2.68	
		24-30	SiL	11	69	20		97									2.68	
W18	Grenada silt	0-6	SiL	16	72	12		91				1.27	79.2	37.7	34.0		2.70	3.18
	loam	6-12	SiL	14	69	17	CL-ML	94	28	22	6	1.40	87.4	28.0	26.5		2.70	2.89
		12-18	SiL	10	63	27		99									2.70	
		18-24	SiCL	8	62	30		98									2.70	
W19	Mixed local	0-6	L	32	50	18		74				1.44	89.9	30.2	29.0		2.69	2.79
	alluvium	6-12	L	48	40	12	CL-ML	58	22	17	5	1.49	93.0	27.5	26.1		2.68	2.66
		12-18	SL	55	32	13		49									2.67	
		18-24	SL	61	24	15		43									2.67	
		24-30	SL	67	18	15		36									2.69	
		30-36	SL	74	12	14		37									2.66	
		36-42	LS	81	8	11		22									2.67	
W20	Cahaba silt	0-6	SiL	32	51	17		77				1.44	89.9	30.1	27.9		2.69	2.79
	loam	6-12	L	47	30	23	CL	56	31	17	14	1.55	96.7	25.0	23.4		2.68	2.53
		12-18	SCL	53	21	26		53									2.67	
		18-24	SCL	63	12	25		41									2.67	
W21	Hortman silt	0-6	SiL	18	70	12		93				1.40	87.4	30.6	28.6		2.71	2.90
	loam	6-12	SiL	13	69	18	CL	96	33	18	15	1.46	91.1	28.4	27.0		2.71	2.77
		12-18	SiCL	10	59	31		97									2.71	
		18-24	SiC	9	50	41		97									2.71	
W22	Grenada silt	0-6	SiL	11	74	15		96				1.39	86.7	31.2	28.8		2.71	2.92
	loam	6-12	SiL	8	67	25	CL	97	41	21	20	1.41	88.0	31.2	29.0		2.71	2.88
		12-18	SiL	10	65	25		97									2.71	
		18-24	SiL	12	66	22		96									2.71	
		24-30	SiL	12	69	19		97									2.71	
		30-36	SiL	13	65	22		96									2.71	
W23	Grenada silt	0-6	SiL	10	77	13		96				1.28	79.9	36.6	32.0		2.71	3.17
	loam	6-12	SiL	8	69	23	CL	97	34	21	13	1.46	91.1	26.8	27.0		2.71	2.77
		12-18	SiCL	7	65	28		98									2.71	
		18-24	SiCL	7	64	29		97									2.71	
		24-30	SiCL	7	65	28		98									2.71	
		30-36	SiL	8	69	23		98									2.71	

(Continued)

Table 6 (Concluded)

Sit No.	Soil Series	Depth of Layer in.	USDA Text. Class.	USDA Texture by Wt, % Sand	Silt	Clay	USCS Soil Class.	USCS Fines %	Atterberg Limits LL	PL	PI	Bulk Density, g/cc	Dry Density pcf	Moisture Content, %, at Atm of Tension Zero	0.06	15.0	Specific Gravity	Total Pore Space in./6 in.
W24	Grenada silt loam	0-6	SiL	14	74	12		93				1.40	[illegible]	30.2	28.6		2.69	2.88
		6-12	SiL	11	67	22	CL	95	33	21	12	1.50	93.6	26.1	25.1		2.70	2.67
		12-18	SiL	11	64	25		95									2.70	
		18-24	SiL	10	65	25		96									2.71	
		24-30	SiL	10	67	23		96									2.71	
W25	Waverly silt loam	0-6	SiL	15	62	23		92				1.26	78.6	49.4	37.2		2.69	3.19
		6-12	SiL	17	57	26	CL	90	36	21	15	1.39	86.7	34.2	30.4		2.70	2.91
		12-18	SiL	15	59	26		92									2.70	
		18-24	SiL	16	60	24		91									2.70	
		24-30	SiL	14	61	25		93									[illegible]	

(4 of 4 sheets)

Table 7

Soil Moisture and Strength Data for Moisture-Strength Sites

Date	Moisture Content % Dry Weight 0- to 6-in. Layer	Moisture Content % Dry Weight 6- to 12-in. Layer	Strength 6- to 12-in. Layer CI	Strength 6- to 12-in. Layer RI	Strength 6- to 12-in. Layer RCI
Site MS1					
12/18/59	31.3	28.5	121	0.18	22
1/13/60	28.3	24.8	162	0.32	52
1/26/60	29.1	26.4	88	0.29	26
2/9/60	29.5	27.2	102	0.29	29
2/18/60	30.8	23.2			
2/25/60	32.9	26.5			
3/7/60	27.0	22.6			
3/10/60	31.3	30.1	57	0.42	24
3/12/60	30.2	27.0			
3/15/60	27.3	21.5			
3/16/60	31.2	24.5			
3/17/60	34.2	25.3			
3/18/60	36.0	25.5			
3/19/60	28.7	21.8			
3/21/60	32.5	28.9			
3/23/60	31.9	24.7			
3/25/60	29.4	23.2			
4/12/60	28.6	22.4			
4/13/60	27.6	26.4	122	0.27	33
4/18/60	28.8	23.4			
4/22/60	29.4	23.2			
5/3/60	27.2	21.4			
5/10/60	28.2	23.6			
5/17/60	25.6	21.4	284	0.78*	222
5/20/60	20.2	18.3	300	NT	--
Site MS2					
12/19/59	39.0	31.9	29	0.47	14
1/13/60	40.2	29.7	28	0.31	9
2/25/60	39.8	33.5			
3/8/60	37.9	34.2			
3/25/60	38.9	36.1			
3/30/60	44.4	37.4	25	0.35	9
3/31/60	42.4	35.0			
4/4/60	45.8	34.4			
4/25/60	40.6	35.8			
5/3/60	46.6	35.6			
5/10/60	40.2	33.8			
5/17/60	37.2	30.9	34	0.33	11
5/23/60	38.3	30.2	37	0.23	9
6/6/60	33.4	25.3	92	0.42	39
6/10/60	29.1	21.7	168	0.47**	79
6/14/60	28.1	25.5	165	0.65†	107
6/16/60	30.6	20.5	195	NT	--

Date	Moisture Content % Dry Weight 0- to 6-in. Layer	Moisture Content % Dry Weight 6- to 12-in. Layer	Strength 6- to 12-in. Layer CI	Strength 6- to 12-in. Layer RI	Strength 6- to 12-in. Layer RCI
Site MS3					
12/19/59	31.7	28.6	41	0.52	21
1/13/60	36.6	26.7	37	0.18	7
2/25/60	33.2	24.0			
4/4/60	33.9	27.2			
4/25/60	27.6	24.9			
5/3/60	32.3	25.2			
5/10/60	35.4	25.1			
5/17/60	30.9	24.6	56	0.28	16
5/20/60	29.4	20.8	102	0.46	47
5/23/60	29.3	21.2	98	0.52	51
6/10/60	31.0	24.5	49	0.41	20
6/14/60	27.2	21.8	92	0.45	41
6/16/60	27.0	20.8	107	0.46	49
Site MS4					
12/19/59	49.3	34.2	86	0.68	58
1/12/60	49.1	40.8	72	0.58	42
2/18/60	44.9	29.4			
2/23/60	50.2	29.4			
3/4/60	49.9	34.8			
3/8/60	46.2	34.4			
4/4/60	44.6	33.4			
4/12/60	43.9	30.0			
4/18/60	44.5	31.0	91	0.82	75
4/22/60	45.1	34.6			
4/25/60	46.9	32.2			
4/29/60	40.6	33.1			
5/3/60	35.0	29.8			
5/10/60	39.6	29.1			
5/16/60	33.6	28.5			
5/17/60	38.0	28.1	100	0.71	71
5/20/60	31.1	25.0	141	0.59	83
5/23/60	31.5	26.4	137	0.66	90
6/6/60	26.0	20.5	297	NT	--

(Continued)

Note: NT indicates no test.
* Based on two valid tests.
** Based on one valid test.
† Based on three valid tests.

(1 of 3 sheets)

Table [illegible] (Continued)

Date	Moisture Content % Dry Weight 0- to 6-in. Layer	Moisture Content % Dry Weight 6- to 12-in. Layer	Strength 6- to 12-in. Layer CI	RI	RCI
Site MS5					
12/18/59	26.3	22.5	66	0.45	30
1/12/60	25.3	21.9	74	0.51	38
2/9/60	23.8	21.6			
2/18/60	24.0	21.6			
2/23/60	28.6	23.6			
3/1/60	26.9	23.0			
3/12/60	25.8	22.0			
3/15/60	27.5	22.8			
3/16/60	28.5	23.7	96	0.44	42
3/18/60	25.0	22.6			
3/21/60	23.6	23.4			
3/22/60	24.0	21.5			
3/23/60	25.7	21.2	89	0.58	52
4/22/60	24.4	21.4			
4/29/60	23.6	20.0			
5/3/60	20.0	17.2			
5/16/60	21.1	18.0			
5/23/60	19.9	16.6	197	0.95	187
Site MS6					
12/18/59	24.4	18.3	154	0.15	23
1/12/60	21.1	17.1	145	0.14	20
2/18/60	23.0	16.8			
2/23/60	22.5	18.8			
3/4/60	23.1	18.8			
3/7/60	23.4	17.0			
3/12/60	24.0	15.4			
3/16/60	23.1	25.0			
3/17/60	22.6	22.5			
3/18/60	25.2	18.8			
3/19/60	23.4	17.8			
3/21/60	26.0	18.1			
3/22/60	22.0	18.2			
4/11/60	22.1	15.7			
4/13/60	22.8	16.7	136	0.38	52
4/18/60	22.8	15.6	214	0.61	131
4/22/60	24.5	15.7			
4/29/60	19.4	14.6			
5/3/60	19.2	13.1			
[illegible]	20.5	15.6			
[illegible]	18.5	13.5			
5/17/60	18.5	13.3	298	NT	--
Site MS7					
12/18/59	23.0	18.2	300	0.17	51
1/12/60	21.6	17.2	228	0.29*	66
1/18/60	27.1	20.8	176	0.29	51
1/26/60	26.2	22.5	153	0.34	52
2/11/60	24.1	19.4			
2/18/60	23.6	20.0	230	0.44	101
2/23/60	28.2	21.8			
3/1/60	25.0	21.2			
3/4/60	27.5	21.4			
3/7/60	24.2	21.3			
3/12/60	24.8	19.2			
3/15/60	25.5	28.3			
3/16/60	28.7	23.1	114	0.32	36
3/17/60	29.6	22.7			
3/18/60	25.3	21.0			
3/21/60	25.5	21.2			
3/22/60	25.8	20.3			
3/24/60	24.0	19.6			
4/12/60	21.6	17.9			
4/25/60	18.3	14.8			
4/29/60	16.3	13.0			
5/4/60	16.8	12.8			
Site MS8					
12/18/59	36.1	33.5	69	0.35	24
1/12/60	35.7	31.6	113	0.34	38
1/18/60	43.7	35.8	70	0.15	11
1/26/60	40.3	33.0	92	0.27	25
2/11/60	41.8	33.2	61	0.42	26
2/18/60	41.0	33.6			
2/23/60	42.5	38.4			
3/1/60	47.1	41.0	75	0.14	10
3/4/60	41.2	35.2			
3/7/60	48.4	42.7			
3/12/60	43.4	35.3			
3/15/60	41.0	28.2			
3/16/60	42.8	37.6	75	0.27	20
3/17/60	51.2	39.1			
3/18/60	46.0	37.9			
3/21/60	42.8	37.5			
3/22/60	44.2	36.5			
3/23/60	43.4	35.4			
4/5/60	43.4	34.8			
4/13/60	[illegible]	31.7	81	0.32	26
4/18/60	38.5	32.5	74	0.37	27
4/22/60	42.6	35.3			
4/25/60	42.8	33.2			
4/29/60	37.4	31.3			
5/4/60	37.0	29.4			
5/10/60	41.0	34.4			
5/16/60	37.9	29.2			
5/18/60	36.3	29.8	123	0.45	55
5/26/60	32.8	27.3	184	0.62	114
5/27/60	33.7	27.2	149	0.60	89
6/1/60	34.7	27.7	174	0.54	94
6/6/60	27.4	24.0	259	1.31	300+

(Continued)

* Based on two valid tests.

Table [illegible] (Concluded)

Date	Moisture Content % Dry Weight: 0- to 6-in. Layer	Moisture Content % Dry Weight: 6- to 12-in. Layer	Strength 6- to 12-in. Layer: CI	RI	RCI
		Site MS9			
1/14/60	40.1	36.4	62	0.58	36
1/21/60	42.4	35.9	46	0.57	26
1/27/60	44.6	33.8	48	0.58	28
2/10/60	37.0	29.7			
2/17/60	41.7	[illegible]	45	0.56	25
3/8/60	44.3	34.3			
3/9/60	43.8	37.5	52	0.51	27
3/12/60	44.0	35.8			
3/15/60	49.2	35.3			
3/21/60	40.2	42.5			
3/22/60	41.8	34.0			
3/23/60	40.7	32.0			
3/24/60	46.1	38.2			
3/25/60	45.1	32.9			
3/30/60	42.0	34.6			
4/2/60	41.0	37.2	46	0.40	18
4/8/60	39.6	32.8	65	0.53	34
4/19/60	37.2	30.0	62	0.78	48
5/3/60	40.4	33.8			
5/11/60	40.3	31.4			
5/19/60	35.2	28.2	87	0.60	52
5/25/60	36.3	27.6	91	0.57	52
6/2/60	35.2	22.6	146	0.72	105
6/7/60	25.9	20.9	234	0.63	147
		Site MS10			
12/14/59	32.3	27.3	149	0.31	46
1/14/60	35.7	31.3	81	0.13	11
2/10/60	33.8	29.3			
2/15/60	35.0	29.4	111	0.22	24
2/19/60	35.6	30.1			
2/23/60	38.8	33.6			
3/4/60	34.4	29.8			
3/8/60	37.4	30.5			
3/12/60	35.4	29.4			
3/16/60	37.4	29.8			
3/17/60	39.6	33.7			
3/18/60	38.5	31.4			
3/19/60	36.0	32.2			
3/22/60	37.3	30.6			
3/24/60	35.6	30.0			
4/4/60	37.3	30.7	110	0.22	24
4/6/60	35.7	29.1	117	0.20	23
4/8/60	35.3	28.8	136	0.24	33
4/19/60	32.8	27.2	199	0.42	84
4/25/60	33.7	27.1			
4/29/60	34.0	27.6			
5/3/60	31.2	26.4			
5/10/60	33.9	28.6			
5/18/60	29.2	25.1	248	0.65	161
5/27/60	27.6	22.7	293	0.75	220
		Site MS11			
12/16/59	35.1	30.4	87	0.41	36
1/11/60	30.3	29.1	96	0.35	34
1/27/60	31.9	29.8	67	0.39	26
2/8/60	34.0	29.1	52	0.49	25
2/15/60	32.4	27.0			
2/19/60	32.2	28.0	101	0.24	24
2/23/60	32.1	30.9			
3/4/60	35.4	30.2			
3/7/60	36.7	31.2			
3/12/60	34.7	28.9			
3/15/60	33.0	27.9			
3/16/60	35.7	30.3			
3/17/60	33.6	30.0			
3/19/60	33.6	30.5			
3/21/60	32.8	32.5			
3/23/60	33.7	28.2			
3/25/60	33.5	29.5			
3/31/60	32.6	32.2			
4/5/60	32.3	29.9			
4/6/60	32.5	29.5	96	0.43	41
4/[illegible]/60	31.0	27.6			
4/18/60	29.1	25.8	116	0.35	41
4/25/60	30.6	25.5			
4/29/60	30.4	26.7			
5/2/60	29.1	26.0			
5/10/60	31.7	28.2			
5/18/60	29.2	26.0	123	0.32	39
5/27/60	28.3	24.8	160	0.42	67
6/1/60	27.9	23.6	154	0.46	71
6/6/60	27.3	23.9	170	0.47	80
6/9/60	27.4	24.3	205	0.57	117
6/13/60	25.1	21.9	244	0.62	151
6/17/60	25.3	22.8	212	0.49	104
		Site MS12			
12/16/59	25.8	23.7	144	0.30	43
1/11/60	27.4	24.6	104	0.39	41
1/27/60	32.4	28.3	70	0.40	28
2/8/60	31.1	27.6	94	0.26	24
2/15/60	28.0	26.1	64	0.29	19
2/19/60	29.3	27.2			
2/23/60	30.4	26.8	94	0.28	26
3/3/60	31.8	29.6			
3/4/60	29.1	27.5			
3/7/60	30.5	29.5	83	0.37	31
3/12/60	36.4	28.8			
3/15/60	31.5	29.0			
3/17/60	33.2	29.7			
3/18/60	31.6	30.8			
3/19/60	33.0	28.8			
3/23/60	31.1	27.4			
3/31/60	33.9	29.5			
4/5/60	33.7	28.2			
4/6/60	30.3	27.9	92	0.43	40
4/9/60	28.7	26.2			
4/12/60	30.0	26.4	99	0.36	36
4/19/60	27.4	24.7	124	0.38	47
4/25/60	31.3	25.5			
4/29/60	29.8	26.7			
5/2/60	30.2	27.2			
5/10/60	30.0	27.1			
5/18/60	26.4	24.0	156	0.46	72
5/27/60	25.4	22.2	212	0.53	112
6/1/60	23.0	20.9	249	0.80	199

(3 of 3 sheets)

Table 8

Soil Moisture and Strength Data for Well Sites

Well No.	Date	Depth to Water Table in.	Moisture Content % Dry Weight 0- to 6-in. Layer	Moisture Content % Dry Weight 6- to 12-in. Layer	Strength 6- to 12-in. Layer CI	Strength 6- to 12-in. Layer RI	Strength 6- to 12-in. Layer RCI
1	3/10/60	0	24.9	19.2	101	0.52	53
2	3/10/60	>42	14.1	10.0	151	NT	--
3	3/10/60	>18	21.9	20.2	89	0.30	27
4	3/10/60	19-1/2	28.6	23.0	66	0.30	20
5	3/10/60	3-1/2	22.2	19.2	64	0.22	14
6	3/10/60	>15	16.8	21.6	145	0.38*	55
7	3/8/60	>26	20.6	16.8	122	0.87	106
8	3/8/60	18-1/2	23.3	22.9	97	0.48**	47
9	3/8/60	23	29.4	28.4	79	0.80	63
10	3/8/60	13-1/2	21.8	22.2	236	0.83**	196
11	3/8/60	18	33.0	26.0	70	0.31	22
12	3/7/60	6-1/2	31.0	26.1	142	0.51	72
13	3/7/60	8	31.9	29.8	83	0.28	23
14	3/9/60	+1/2	55.2	44.3	45	0.38	17
15	3/9/60	>38	35.1	28.6	92	0.31	29
16	3/9/60	>27	32.5	26.0	107	0.58	62
17	3/9/60	6	35.0	29.0	74	0.66**	49
18	3/9/60	12-1/2	36.0	29.7	74	0.52	38
19	3/9/60	1-1/2	29.0	25.5	77	0.41	32
20	3/9/60	10	28.8	24.6	92	0.51**	47
21	3/12/60	10	28.5	27.6	56	0.52	29
22	3/12/60	7	29.6	30.0	99	0.86	86
23	3/9/60	18-1/2	31.2	30.6	68	0.62	42
24	3/12/60	11	28.9	28.7	124	0.66	82
25	3/9/60	7	39.4	33.0	97	0.52	50

Note: NT indicates no test; plus sign indicates water table was aboveground.
* Two valid tests.
** Three valid tests.

Table 9

Rainfall Data for Test Sites

Date	Rainfall, in.: Sites MB1-MB8 and W1-W13	Rainfall, in.: Sites MB9 and W14-W25	Rainfall, in.: Sites MB10-MB12
10/1/59	0.10	0.10	
10/5/59	0.70	0.80	0.50
10/13/59	1.70	1.50	1.05
10/23/59	0.35	0.20	0.25
11/3/59	1.15	0.80	0.95
11/4/59	0.55	1.50	0.95
11/13/59	0.60	0.55	0.35
11/14/59			0.15
11/15/59		0.10	
11/26/59	0.30	0.50	0.30
12/1/59		0.10	
12/4/59		0.15	
12/5/59	0.10		0.20
12/10/59	0.20	0.15	
12/11/59	0.85	0.55	0.75
12/15/59	0.80	0.90	0.55
12/16/59	1.05	1.30	1.70
12/22/59	0.10		
12/27/59	0.50	0.45	0.30
12/31/59	0.50	0.25	
1/1/60			0.40
1/2/60	0.10		0.10
1/4/60		0.10	
1/5/60	1.05	1.30	1.30
1/6/60			0.20
1/13/60		0.25	0.10
1/14/60	0.15	0.25	0.15
1/16/60	0.35	0.80	0.75
1/26/60	1.05	1.05	1.15
1/28/60	0.60	0.40	0.30
1/29/60			0.15
2/3/60	1.05	0.95	0.85
2/4/60	0.45		0.20
2/15/60	0.15		
2/17/60	0.35		
2/18/60			0.15
2/20/60	0.45	0.45	0.40
2/24/60	1.60	1.40	1.60
2/27/60			0.10
2/28/60		0.15	
3/1/60	1.45	1.50	1.05
3/2/60		0.25	0.75
3/3/60	0.45		
3/8/60	0.30	0.25	0.20
3/10/60	0.10	0.10	0.10
3/14/60	1.15	1.10	1.10
3/15/60	0.15	0.25	0.30
3/24/60	0.35	0.55	0.55
3/27/60	0.20	0.35	0.40
3/29/60		0.20	0.30
4/5/60	0.10		0.10
4/16/60		0.15	
4/17/60	0.20		
4/20/60	0.85	0.65	0.30
4/25/60	0.60	0.55	0.10
4/26/60		0.55	0.40
4/29/60		0.10	0.35
5/4/60	0.80	0.90	1.05
5/5/60	0.95	1.30	0.70
5/6/60			0.20
5/20/60	0.50	0.30	0.35
5/30/60	0.70		0.35
5/31/60		0.20	
6/1/60	0.10	0.60	0.40
6/3/60		0.35	0.10
6/15/60	0.70	0.65	0.75
6/16/60			0.15
6/24/60		1.40	1.05
6/25/60	1.85	0.25	
6/26/60	1.35	0.65	0.60
7/5/60	0.40		0.10
7/10/60			1.10
7/26/60			0.25
7/28/60			0.25
7/31/60	0.35	0.25	
8/1/60		0.15	0.20
8/6/60		0.60	
8/9/60	0.80	2.75	
8/10/60	0.70	0.75	3.20
8/11/60			1.55
8/14/60	0.60	0.40	1.30
8/18/60	1.50	0.40	
8/19/60			0.60
8/21/60	2.70	2.55	1.85
8/22/60	0.10	0.25	1.25
8/26/60	0.15		1.15
8/28/60	0.10	0.25	
8/29/60		1.45	0.55
8/31/60	0.40	0.70	
9/9/60		0.35	
9/10/60	0.35	0.20	0.80
9/21/60	0.80		
9/26/60	0.20	0.10	
9/27/60			0.25
10/4/60	0.10		
10/5/60	0.55	0.60	1.25
10/6/60	1.65	1.50	
10/7/60			0.65
10/16/60			0.20
10/25/60	0.35		
10/26/60		0.30	0.25
10/29/60	0.20	0.25	0.15
10/30/60	0.10	0.10	
11/8/60	0.45	0.20	
11/9/60	1.20	1.60	1.50
11/15/60	1.20		
11/16/60		0.80	0.80
11/17/60		2.35	
11/22/60	0.35		1.70
11/28/60	0.70		
12/5/60	1.45	1.00	0.85
12/6/60	2.10	0.80	0.25
12/7/60	0.50	0.50	1.55
12/8/60	0.60	0.60	1.05
12/10/60	0.50	0.75	
12/11/60			0.45
12/14/60	0.75	0.30	
12/15/60			0.25
12/27/60	0.20	0.15	
12/28/60	2.70	1.50	0.25
12/29/60	0.15	0.45	1.70
12/30/60	1.00	1.00	
12/31/60	0.40	0.45	1.40
1/6/61		0.30	
1/7/61	0.65	0.55	0.80
1/8/61			0.10
1/13/61			0.10
1/14/61	0.40	0.25	
1/15/61			0.10
1/18/61	0.15	0.35	
1/19/61			0.45
1/24/61	0.10	0.15	0.10
1/25/61	0.15	0.20	
1/26/61			0.15
2/1/61	0.15	0.15	
2/2/61		0.10	0.30
2/6/61	0.60	1.00	0.10
2/7/61			0.50
2/16/61	0.70	0.75	
2/17/61	1.10	1.15	1.55
2/18/61	0.20	0.10	0.15
2/19/61	2.25	0.65	
2/20/61	1.90	2.65	2.00
2/21/61	0.45	0.85	1.25
2/22/61			0.35
2/24/61	0.50	0.45	0.35
2/25/61			0.30
2/27/61	0.45	0.50	
2/28/61			0.40

Note: Rainfall amounts were based primarily on daily records of weather stations in the area, modified by data from frequent measurements of cans and gages on the sites. Records of weather stations were used at sites as follows:

Weather Station	Site
Crossett Timber Management Laboratory	MB10-MB12
Georgia-Pacific Corp. (Yale District Hdqr)	MB1-MB8 and W1-W13
Georgia-Pacific Corp. (Berlin District Hdqr)	MB9 and W14-W25

Rainfall of less than 0.1 in., the minimum-size storm, is not included in the rainfall amounts shown.

Table 10

Depth to Water Table, Moisture-Strength Sites

Date	Depth to Water Table, in.																							
	MS1		MS2		MS3		MS4		MS5		MS6		MS7		MS8		MS9		MS10		MS11		MS12	
	D	S	D	S	D*	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S
11/16/59																					32	Dry	Dry	Dry
11/17/59							Dry	Dry					Dry	Dry	Dry	Dry								
11/18/59									Dry	Dry	Dry	Dry												
11/19/59					53	Dry																		
11/20/59	Dry	Dry	12	12																				
11/23/59																	Dry	Dry						
12/14/59																			15	7				
12/15/59																			7	13				
12/16/59																							Dry	Dry
12/18/59	Dry	4-1/2							Dry	Dry	19	1	Dry	Dry	Dry	Dry					9	6		
12/19/59			+2	+2		+2	3-1/2	3																
1/11/60																					15	16-1/2	28	Dry
1/12/60							1/2	2	Dry	Dry	17-1/2	1	21-1/2	Dry	15	Dry								
1/13/60	Dry	7	+3	+3		+14																		
1/14/60																	16-1/2	11-1/2	9	+1				
1/15/60																	21-1/2	12-1/2						
1/18/60											35	1	Dry	4	8	7								
1/19/60	Dry	4	+4	+4		+13	0	1	Dry	Dry														
1/21/60																	21	11-1/2						
1/26/60	Dry	14	+1-1/2	+1-1/2		+29	+4	+4	Dry	Dry	40	1	Dry	Dry	17	Dry								
1/27/60																	23	9			1-1/2	1-1/2	2	2
1/28/60	Dry	2	+4	+4		+18	+8	+8	[illegible]	Dry	45	1-1/2	Dry	3-1/2	7	6			15	1				
2/8/60																					4-1/2	4-1/2	6	7-1/2
2/9/60	Dry	1-1/2	+3	+3		+13-1/2	1/2	1/2	Dry	Dry	37	0												
2/10/60																	18	11-1/2	18	4				
2/11/60													Dry	Dry	11	11					11	11	15	15
2/15/60																			21-1/2	17	17-1/2	17-1/2	20-1/2	20-1/2
2/16/60																	21-1/2	16	23	13	16	16	20	20
2/17/60																	22	26			16-1/2	16-1/2	20	20
2/18/60	Dry	6	+3-1/2	+3-1/2		+18	1	0	Dry	Dry	33-1/2	0	Dry	10	9	7			24	2-1/2	11-1/2	11-1/2	19-1/2	19-1/2
2/19/60																			24	5-1/2	13-1/2	13-1/2	19-1/2	19-1/2
2/23/60							1	1/2	Dry	Dry	32	0	Dry	8	8	7-1/2			24-1/2	1/2	7-1/2	7-1/2	13-1/2	1[illegible]
2/25/60	Dry	0	+18-1/2	+18-1/2		+9																		
3/1/60	Dry	0	+3-1/2	+3-1/2		+18	1/2	0	Dry	Dry	29-1/2	0	Dry	3	7	4-1/2			25-1/2	+1/2	1-1/2	1	3	[illegible]
3/3/60	Dry	0	+16	+16		+27-1/2	+1/2	+ -1/2	Dry	Dry	29	0	Dry	1-1/2	1/2	+2		+6	25-1/2	+1/2	1-1/2	1-1/2	2	2-1/2
3/4/60	Dry	0	+13	+8-1/2		+32	+5	+7	Dry	Dry	28-1/2	0	Dry	2	0	+1/2		+6	26	0	1-1/2	1-1/2	3	3
3/5/60	Dry	0	+10	+5-1/2		+39	+1	+	Dry	Dry	28-1/2	0	Dry	3-1/2	2-1/2	2-1/2	+?	+?	26	1/2	2	2	5	4
3/7/60	Dry	1/2	+8	+6		+?	+10	+11	Dry	Dry	27-1/2	0	Dry	5-1/2	7	6-1/2	+?	+?	27	1	2	2	5-1/2	7
3/8/60	Dry	1/2	+6	+4-1/2		+32-1/2	+10	+10	Dry	Dry	27-1/2	0	Dry	6	8	7	15-1/2	7	27-1/2	2	2	2-1/2	5	6-1/2
3/9/60																	16	9-1/2			2	2	3	4
3/10/60	Dry	0	+5	+5		+29-1/2	+7	+7	Dry	Dry	27	0	Dry	2-1/2	6	5-1/2			27	1/2	2	2	[illegible]	5-1/2
3/12/60	Dry	0	+4	+4		+27	+5-1/2	+5-1/2	Dry	Dry	26-1/2	0	Dry	4	8	8	17	11	27-1/2	0	2-1/2	3	6	8
3/14/60	Dry	1/2	+3	+5		+26	+3	+4-1/2	Dry	Dry	26	0	Dry	1-1/2	5	0	18-1/2	9-1/2	27-1/2	0	1/2	1	1/2	1/2
3/15/60	Dry	1/2	+9-1/2	+17-1/2		>+26	+5	+16-1/2	Dry	Dry	26	0	Dry	1	1-1/2	1/2	18	5	27-1/2	0	1	[illegible]	1-1/2	1-1/2
3/16/60	Dry	1/2	+10-1/2	+11		>+26	+7-1/2	+5	Dry	Dry	26	0	Dry	1	1	1	+?	+?	27-1/2	1/2	1	1-1/2	2	2

(Continued)

Note: +1 = water standing 1 in. aboveground.
+? = water standing aboveground but height unknown.
>+26 = water standing more than 26 in. aboveground.
Dry = well dry.
0 = water table at ground surface.
D = deep well.
S = shallow well.
* Deep well at site 3 was pulled out late in November 1959.

Table 10 (Continued)

Date	MS1 D	MS1 S	MS2 D	MS2 S	MS3 D	MS3 S	MS4 D	MS4 S	MS5 D	MS5 S	MS6 D	MS6 S	MS7 D	MS7 S	MS8 D	MS8 S	MS9 D	MS9 S	MS10 D	MS10 S	MS11 D	MS11 S	MS12 D	MS12 S
	Depth to Water Table, in.																							
3/17/60	Dry	0	+10-1/2	+6-1/2		>+26	+9	+11-1/2	Dry	Dry	26	0	Dry	4	2	1-1/2	+?	+?	27-1/2	0	1-1/2	1-1/2	[illegible]	[illegible]
3/18/60	Dry	0	+8	+4		>+26	+11	+12	Dry	Dry	25-1/2	0	Dry	6	5	5	+?	+?	24-1/2	1	2	2	[illegible]	[illegible]
3/19/60	Dry	1	+7	+4-1/2		>+26	+12	+13	Dry	Dry	26	1/2	Dry	7	7-1/2	7	+?	+?	28	3	2-1/2	2-1/2	[illegible]	[illegible]
3/21/60	Dry	4-1/2	+5	+3		>+26	+12	+13	Dry	Dry	25-1/2	1/2	Dry	12	10	9-1/2	14-1/2	10-1/2	28-1/2	9-1/2	6	6		
3/22/60	Dry	6	+4	+3-1/2		>+26	+13-1/4	+13	Dry	Dry	25-1/2	0	Dry	Dry	10-1/2	9-1/2	15	12	28-1/2	11	7	7-1/2	12	10
3/23/60	Dry	7	+?	+?		>+26	+?	+?	Dry	Dry	25-1/2	0	Dry	12	8-1/2	7-1/2	15-1/2	13	29	8	8	8-1/2	11	1
3/24/60	Dry	8	+4-1/2	+3		>+26	+12	+13	Dry	Dry	25-1/2	0	Dry	Dry	9-1/2	8-1/2	16	13	29	10	5-1/2	4-1/2	1	1
3/25/60	Dry	1-1/2	+4	+6		>+26	+14	+13-1/2	Dry	Dry	25-1/2	0	Dry	5	5-1/2	5-1/2	16-1/2	11	29	0	5	5	2-1/2	[illegible]
3/26/60	Dry	0	+3-1/2	+3-1/2		>+26	+12-1/2	+12-1/2	Dry	Dry	25-1/2	0	Dry	8-1/2	8	7-1/2	17	12-1/2	29-1/2	1				
3/28/60	Dry	1/2	+3	+4-1/2		>+26	+10-1/2	+9	Dry	Dry	25-1/2	0	Dry	4	6-1/2	6	18	12	29	+1/2	1-1/2	1-1/2	2	[illegible]
3/29/60	Dry	+1/2	+4-1/2	+4-1/2		>+26	+9-1/2	+8-1/2	Dry	Dry	25-1/2	0	Dry	7	8	6-1/2	18	13	29	+1/2	2	2	[illegible]	[illegible]
3/30/60	Dry	0	+4	+3		>+26	+6	+5	Dry	Dry	25	0	Dry	11	8	8	18	11-1/2	28-1/2	0	1-1/2	1-1/2	2	2-1/2
3/31/60	Dry	1	+3	+3		+22-1/2	+4-1/2	+3-1/2	Dry	Dry	25	1/2	Dry	Dry	10	9-1/2	18	13	28-1/2	1-1/2	2	2	4	5
4/2/60	Dry	4	+?	+?		+?	0	0	Dry	Dry	25-1/2	1/2	Dry	Dry	11	11	19	15	28-1/2	6	4	4	[illegible]	[illegible]
4/4/60	Dry	11	+2	+3-1/2		+3-1/2	1/2	1/2	Dry	Dry	25-1/2	1	Dry	Dry	12-1/2	Dry	19-1/2	16	28-1/2	11-1/2	8-1/2	8-1/2	12	[illegible]
4/5/60	Dry	14	+2	+3-1/2		+3-1/2	1-1/2	2	Dry	Dry	25-1/2	2	Dry	Dry	13-1/2	Dry	20	17-1/2	29	17	12-1/2	13	15	[illegible]
4/6/60	Dry	17	+2	+3-1/2		+3	2-1/2	2	Dry	Dry	25-1/2	5	Dry	Dry	14-1/2	Dry	21	18	29	20	14-1/2	14-1/2	16	17
4/8/60	Dry		+?	+?		+2-1/2	4	4	Dry	Dry	26-1/2	8-1/2	Dry	Dry	16	Dry	32	19-1/2	29-1/2	Dry	20-1/2	20-1/2	21-1/2	22
4/9/60																					20	20		
4/11/60	Dry	21-1/2	+1	+3-1/2		+2	4-1/2	4-1/2	Dry	Dry	27	10-1/2	Dry	Dry	17	Dry	24	22	31	Dry	24	24-1/2	24-1/2	[illegible]
4/12/60	Dry	22-1/2	+1	+2		+2	5-1/2	5-1/2	Dry	Dry	27	14-1/2	Dry	Dry	17	Dry	24	22-1/2	31	Dry	25	25-1/2	[illegible]	[illegible]
4/13/60	Dry	23-1/2	+1	+2		+1	6-1/2	6-1/2	Dry	Dry	27-1/2	17-1/2	Dry	Dry	18	Dry								
4/15/60																	27	Dry					31-1/2	Dry
4/18/60	Dry	27-1/2	+1	+2		0	9	9	Dry	Dry	29	23	Dry	Dry	20-1/2	Dry					31	Dry	35	Dry
4/19/60																	29	Dry	Dry	Dry	32-1/2	Dry	36-1/2	Dry
4/20/60															24	Dry	30	Dry	35	Dry	34	Dry	38-1/2	Dry
4/21/60																	30	22	35	Dry	29	Dry	37	Dry
4/22/60	Dry	15	+2	+3		+3	3	1-1/2	Dry	Dry	29-1/2	9	Dry	Dry	28-1/2	Dry			35	Dry	31	Dry		
4/25/60	Dry	23-1/2	+1	+1		+2-1/2	6-1/2	6-1/2	Dry	Dry	30	18-1/2	Dry	Dry	22	Dry			35-1/2	Dry	36-1/2	Dry	43	Dry
4/26/60	Dry	24-1/2	+1	+2-1/2		+1	6	2	Dry	Dry	30	18-1/2	Dry	Dry	23-1/2	Dry	31-1/2	Dry	36	Dry	16	16-1/2	2	1-1/2
4/27/60	Dry	25	+1	+2-1/2		+1	5	5-1/2	Dry	Dry	30	15-1/2	Dry	Dry	22-1/2	Dry	31	20	35-1/2	Dry	17-1/2	18-1/2	8	[illegible]
4/28/60																			36	Dry	21	22	12-1/2	14-1/2
4/29/60	Dry	25-1/2	+1/2	+1		+1/2	9	9	Dry	Dry	30	20-1/2	Dry	Dry	24	Dry			36	Dry	23	24	15	17
5/2/60																	28-1/2	15-1/2	36-1/2	Dry	28-1/2	Dry	25	Dry
5/3/60	Dry	27-1/2	1	1-1/2		6	14-1/2	13-1/2	Dry	Dry	31	27	Dry	Dry	27-1/2	Dry	28	18	37	Dry	31	Dry	28-1/2	Dry
5/4/60															28-1/2	Dry	28	21						
5/6/60	Dry	7	+7			5	5	+1/2	Dry	Dry	31-1/2	4	Dry	Dry	11-1/2	2-1/2			17	3	1-1/2	2		
5/7/60																							7-1/2	[illegible]
5/9/60	Dry	22	+1	+1		+2-1/2	8	8	Dry	Dry	31-1/2	17	Dry	Dry	16	Dry			16-1/2	19	19	20	17-1/2	[illegible]
5/10/60	Dry	23-1/2	+1	0		+1	10-1/2	10	Dry	Dry	31-1/2	21-1/2	Dry	Dry	18	Dry			24	Dry	20-1/2	21-1/2	19	21-1/2
5/11/60																	22	13	27-1/2	Dry	25-1/2	Dry		
5/12/60																	22	16-1/2					28	Dry
5/13/60	Dry	26	2-1/2	4		4	17-1/2	15-1/2	Dry	Dry	32-1/2	27-1/2	Dry	Dry	23-1/2	Dry			31	Dry	30	Dry	30	Dry
5/16/60	Dry	29-1/2	9-1/2	12		15-1/2	22	Dry	Dry	Dry	35-1/2	Dry	Dry	Dry	29	Dry					36-1/2	Dry	39	Dry
5/17/60	Dry	29-1/2	12	13-1/2		19	24	Dry	Dry	Dry	36	Dry												
5/18/60															31-1/2	Dry			37-1/2	Dry	40	Dry	43	Dry
5/19/60																	26-1/2	Dry						
5/20/60	Dry	30	20-1/2	18-1/2		24-1/2	28	Dry	Dry	Dry	47-1/2	Dry	Dry	Dry	41	Dry			47-1/2	Dry	43-1/2	Dry	47	Dry
5/23/60	Dry	Dry	17	16-1/2		24-1/2	30	Dry	Dry	Dry	47-1/2	Dry												
5/25/60																	38	Dry						
5/26/60															Dry	Dry								
5/27/60															Dry	Dry			48-1/2	Dry	Dry	Dry	Dry	Dry
6/1/60															Dry	Dry					Dry	Dry	Dry	Dry
6/2/60																	47	Dry						
6/6/60			38	Dry		+2-1/2	44	Dry							Dry	Dry					Dry	Dry		
6/7/60																	Dry	Dry						
6/9/60																					Dry	Dry		

(Continued)

(2 of [illegible] sheets)

Table 10 (Concluded)

Date	MS1 D	MS1 S	MS2 D	MS2 S	MS3 D	MS3 S	MS4 D	MS4 S	MS5 D	MS5 S	MS6 D	MS6 S	MS7 D	MS7 S	MS8 D	MS8 S	MS9 D	MS9 S	MS10 D	MS10 S	MS11 D	MS11 S	MS12 D	MS12 S
											Depth to Water Table, in.													
6/10/60			Dry	Dry		10																		
6/13/60																					Dry	Dry		
6/14/60			Dry	Dry		29																		
6/16/60			Dry	Dry		Dry															Dry	Dry		
Measurements stopped 6/16/60, started again 11/23/60																								
11/23/60	Dry	Dry	26-1/2	2		12	35	Dry	Dry	Dry	31	17	Dry	Dry	Dry	Dry	Dry	Dry	18-1/2	Dry	13-1/2	Dry	Dry	Dry
11/25/60	Dry	Dry	24-1/2	3-1/2		17-1/2	38	Dry	Dry	Dry	29-1/2	19	Dry	Dry	Dry	Dry	Dry	Dry	22	23	23	Dry	Dry	Dry
11/28/60	Dry	Dry	22	4-1/2		22	42	Dry	Dry	Dry	30	24	Dry	Dry	Dry	Dry	Dry	Dry	27-1/2	Dry	29	Dry	Dry	Dry
11/30/60	Dry	Dry	20	0		5	17	12	Dry	Dry	27-1/2	13	Dry	Dry	Dry	Dry	Dry	Dry	29	Dry	32	Dry	Dry	Dry
12/2/60	Dry	Dry	18	1-1/2		14	27	13-1/2	Dry	Dry	25	17	Dry	Dry	Dry	Dry	Dry	Dry	32-1/2	Dry	35	Dry	Dry	Dry
12/5/60	Dry	Dry	16	+1		13	27	3	Dry	Dry	23	19	Dry	Dry	Dry	Dry	Dry	Dry	23	11	38	Dry	Dry	Dry
12/7/60	Dry	15	12-1/2	17-1/2		+.	4	0	Dry	Dry	16	1	Dry	5	Dry	9	Dry	Dry	6-1/2	1/2	2-1/2	4	48	Dry
12/9/60	Dry	9	8	+6-1/2		+2	3	0	Dry	Dry	11	1/2	Dry	3	Dry	8	15	20	6-1/2	1	3-1/2	6-1/2	27-1/2	Dry
12/12/60	Dry	7	6	+3		+2	3-1/2	1-1/2	Dry	Dry	7	1	Dry	7	Dry	Dry	13	17	7	1	11	15	32-1/2	Dry
12/14/60	Dry	1.	6	+2		+2	4-1/2	4	Dry	Dry	6	1	Dry	10	Dry	Dry	16	20	8	2- /2	16	19-1/2	37	Dry
12/16/60	Dry	10	5	+2		+1-1/2	4	4	Dry	Dry	5	1	Dry	8	48	Dry	15	20	7	1	15	19	38	Dry
12/19/60	Dry	14-1/2	5	+1		+1/2	6-1/2	6	Dry	Dry	[illegible]	2	Dry	Dry	42	Dry	19	23	9-1/2	5	21-1/2	25	43	Dry
12/21/60	Dry	14-1/2	5	+1		+1/2	6-1/2	6	Dry	Dry	5	2	Dry	Dry	42	Dry	19	23	9-1/2	5	21-1/2	25	43	Dry
12/23/60	Dry	18-1/2	.-1/2	+1		2	10	5-1/2	Dry	Dry	7	5-1/2	Dry	Dry	42	Dry	22	Dry	15	12	27	Dry	Dry	Dry
12/27/60	Dry	20-1/2	.	1/2		7	12	10-1/2	Dry	Dry	7-1/2	7	Dry	Dry	Dry	Dry	23-1/2	Dry	19	13	29-1/2	Dry	Dry	Dry
12/28/60	Dry	21	4	+1		7-1/2	7-1/2	1-1/2	Dry	Dry	7-1/2	5-1/2	Dry	12	Dry	Dry	24	Dry	19	7	27-1/	Dry	Dry	Dry
12/30/60	Dry	7	+2-1/2	+15-1/2		+3	1/2	0	Dry	Dry	7	1	Dry	2	30	2-1/2	8	11	7	.	3-1/2	5	7	9
1/3/61	Dry	3	+5	+4		+9	1	1/2	Dry	Dry	6	1/2	Dry	4-1/2	19	5	+?	+?	7-1/2	1	9	11	11-1/2	12-1/2
1/4/61	Dry	.	+4	+.-1/2		+8-1/2	2	1	Dry	Dry	5-1/2	1/2	Dry	6	19-1/2	7	+?	+?	8	1	11-1/2	14	14	15-1/2
1/6/61	Dry	6-1/2	+3	+.-1/2		+4-1/2	2-1/2	2	Dry	Dry	5-1/2	1/2	Dry	9	20	9	+?	+?	10	4	15-1/2	18	19-1/2	21
1/9/61	Dry	2	+.	+4		+3	1	1/2	Dry	Dry	5	1/2	Dry	3-1/2	19	7	8	12	8	1	6	8	8-1/2	4
1/11/61	Dry	.	+2	+3		+2	2	1	Dry	Dry	5	1/2	Dry	7	19	9	10	13	8-1/2	3	11	13	13-1/2	13-1/2
1/13/61	Dry	6-1/2	+2	+2-1/2		+2-1/2	2	1	Dry	Dry	5	1/2	Dry	7	20	10	11	13-1/2	9	1	11	13	14	13-1/2
1/16/61	Dry	4	+1	+.		+2	1	1	Dry	Dry	5	1/2	Dry	5	20	9-1/2	10-1/2	13	8	1	11	14	17-1/2	15
1/18/61	Dry	8-1/2	+1	+2-1/2		+2	2-1/2	1-1/2	Dry	Dry	5	1/2	Dry	10	20-1/2	11-1/2	13	15	8-1/2	2	15-1/2	18	21	21-1/2
1/20/61	Dry	6	+1	+2-1/2		+2	1	1/2	Dry	Dry	5	1/2	Dry	7-1/2	20	9	12	15	8-1/2	1-1/2	10	13	16-1/2	16
1/23/61	Dry	11	+1	+2		+1	2-1/2	2	Dry	Dry	5	1	Dry	Dry	20-1/2	Dry	15	17	12	8	16-1/2	18	21	21
1/25/61	Dry	13-1/2	+1/2	+2		+2	3-1/2	3	Dry	Dry	5	1	Dry	Dry	21-1/2	Dry	16	17-1/2	14	6	16	19	23	23-1/2
1/27/61	Dry	14	0	+2		0	3-1/2	2-1/2	Dry	Dry	5	1	Dry	Dry	21-1/2	Dry	16	17	13	4	18	20	23-1/2	23
1/30/61	Dry	15-1/2	0	+2		1	3	1-1/2	Dry	Dry	5	1/2	Dry	Dry	22	Dry	16	18-1/2	12	6	20	21	25	24
2/1/61	Dry	16	0	+2		1/2	3	2	Dry	Dry	4-1/2	1/2	Dry	Dry	22-1/2	Dry	17	19	13	6	20	21	25	24
2/3/61	Dry	12-1/2	0	+2		1	1-1/2	1-1/2	Dry	Dry	4-1/2	1/2	Dry	9	22	Dry	13	16	12	1	15	16-1/2	20	19
2/6/61	Dry	15	0	+2		.	2-1/2	2	Dry	Dry	4-1/2	1/2	Dry	11-1/2	21-1/2	Dry	14	16	12	1-1/2	15	16-1/2	21-1/2	20-1/2
2/8/61	Dry	6	0	+3		1	1	1/2	Dry	Dry	4-1/2	1/2	Dry	4	19-1/2	8	8-1/2	12	11	1	5	6	7	.
2/10/61	Dry	6	0	+2		1-1/2	1	1	Dry	Dry	4-1/2	1/2	Dry	8	18	10-1/2	11-1/2	13-1/2	11	1	9	10-1/2	9-1/2	10-1/2
2/13/61	Dry	12	0	+2		5	2-1/2	2	Dry	Dry	4-1/2	1/2	Dry	Dry	18	12	13	15	13	4-1/2	16	17	14	15
2/15/61	Dry	15	0	+2		.	3	2-1/2	Dry	Dry	4-1/2	1/2	Dry	Dry	17-1/2	Dry	14-1/2	16-1/2	15	7	19	21	19	19
2/17/61	Dry	12	0	+4		+2	1	+1/2	Dry	19-1/2	4	0	Dry	3	16-1/2	0	6	6	16	1/2	4-1/2	5-1/2	7	6
2/1./61	Dry	4	+1-1/2	+1.-1/2		2	0	0	Dry	Dry	4	0	Dry	1	14	1-1/2	4	8	16-1/2	1/2	2	1-1/2	1	1/2
2/20/61	Dry	1/2	+4	+22-1/2		+10	1	+4	19	18	4	0	Dry	1/2	10	+5	+?	+?	17	0	1	1	0	1/2
2/21/61	Dry	2	+10	+2.		+?	+14	+22	Dry	Dry	4	0	Dry	1		+21	+?	+?	17	1/2	1-1/2	1-1/2	0	1
2/2./61	Dry	1	+1.	+15		+?	+?	+?	Dry	Dry	4	0	Dry	1-1/2	+5	1	+?	+?	18	1-1/2	2	1-1/2	.	4
2/27/61	Dry	1-1/2	+.	+4		+?	+?	+?	Dry	Dry	4	0	Dry	3	2-1/2	6-1/2	+?	+?	18-1/2	2	2-1/2	2	5	6

Table 11

Depth to Water Table, Well Sites

Date	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21	W22	W23	W24	W25
										Depth to Water Table, in.															
11/17/59									Dry																
11/23/59																								Dry	
11/24/59																									Dry
12/3/59																			Dry	Dry	Dry	Dry	Dry		
12/4/59										Dry	Dry														
12/14/59												Dry	Dry												
1/2/60										27	Dry														
1/14/60																								21-1/2	
1/15/60														Dry	Dry	Dry	26	Dry	Dry	13	12	Dry	Dry	21-1/2	16-1/2
1/18/60					7	Dry	Dry	Dry	47																
1/19/60	26	Dry	Dry	Dry	7	Dry	Dry	Dry		21	Dry	10	Dry												
1/21/60												20	Dry	32-1/2	Dry	Dry	15	Dry	29	Dry	16	Dry	Dry	23-1/2	16
1/26/60	9	Dry	Dry	Dry	18	Dry	Dry	Dry	48	27	Dry														
1/27/60																			5-1/2	10	7-1/2	33	30		
1/28/60	11	Dry	Dry	Dry	24-1/2	Dry	Dry	Dry		13-1/2	Dry	1	Dry												
2/9/60	1	Dry	Dry	Dry	6	Dry	Dry	Dry	31	13	Dry														
2/10/60												5	21	7	Dry	Dry	14	Dry	26-1/2	Dry	Dry	32	33-1/2	15-1/2	10-1/2
2/11/60										20	Dry														
2/16/60																								20-1/2	16
2/17/60														13	Dry	Dry	17-1/2	Dry	Dry	Dry	Dry	Dry	Dry	21	16-1/2
2/18/60	3-1/2	Dry	Dry	Dry	5	Dry	Dry	Dry	34-1/2	21	Dry	9	Dry												
2/23/60					5-1/2	Dry	Dry	Dry	31																
2/25/60	1/2	Dry	15	16-1/2		Dry	22	11-1/2		0	21	8	3	+5	19-1/2	11	6-1/2	7	3	11-1/2	6-1/2	8-1/2	20	3-1/2	
3/1/60	0	Dry	Dry	12	3-1/2	Dry	Dry	19-1/2	27	4	32-1/2	7	8-1/2	1	Dry	25	10	17-1/2	17-1/2	14-1/2	9	19-1/2	25	11-1/2	
3/3/60	0	Dry	7	16	2	Dry	23-1/2	11-1/2	23-1/2	2	7-1/2	6-1/2	3	+15-1/2	18	10	7-1/2	7-1/2	2-1/2	7	2-1/2	0	15	4-1/2	+3-1/2
3/4/60	0	Dry	Dry	18	2-1/2	Dry	Dry	13-1/2	23	6	11-1/2	6	4	+1-1/2	31-1/2	18	9-1/2	12	2-1/2	6-1/2	4-1/2	1	18	9	+?
3/5/60	0	Dry	Dry	19	3	Dry	Dry	15	22-1/2	9-1/2	13-1/2	6	5-1/2	+1	37	20-1/2	11-1/2	14	3-1/2	7	7	4-1/2	19	11	+?
3/7/60	0	Dry	Dry	21-1/2	3-1/2	Dry	Dry	17	22	13	17	6-1/2	8	2-1/2	Dry	24	12	17	1	12	8	6-1/2	21	12	+?
3/8/60	0	Dry	Dry	22	3-1/2	Dry	Dry	18-1/2	23	13-1/2	18	6-1/2	9	0	Dry	25-1/2	13	18	5	15	9-1/2	8	21-1/2	12-1/2	3-1/2
3/9/60														+1/2	Dry	Dry	6	12-1/2	1-1/2	10	4-1/2	2	18-1/2	6-1/2	7
3/10/60	0	Dry	Dry	19-1/2	3-1/2	Dry	Dry	15	21	4	14-1/2	6	5												
3/11/60														0	Dry										
3/12/60	1-1/2	Dry	Dry	22	5	Dry	Dry	17-1/2	20-1/2	7	18	5-1/2	7	1/2	Dry	Dry	10	14-1/2	3	7	10	7	21	11	11-1/2
3/14/60	1-1/2	Dry	Dry	22-1/2	4	Dry	Dry	12-1/2	20	2-1/2	14	5	3	1/2	Dry	25-1/2	7-1/2	16	4	14-1/2	3-1/2	5-1/2	22-1/2	8	8-1/2
3/15/60	1-1/2	Dry	35	16	2	Dry	24	11	17	+2	2	4-1/2	2-1/2	+7-1/2	12	7	6	5	1/2	5-1/2	1	1/2	13	1-1/2	6
3/16/60	1-1/2	Dry	16	18	3	Dry	Dry	13	14-1/2	+1/2	4	4	3	+4-1/2	24	9-1/2	7-1/2	8-1/2	1-1/2	4	1-1/2	0	16-1/2	5-1/2	+?
3/17/60	1-1/2	Dry	Dry	19	4	Dry	Dry	15-1/2	14-1/2	4-1/2	8	4	4-1/2	1	36-1/2	16	10	12-1/2	2-1/2	7	5-1/2	3-1/2	19	9-1/2	+?
3/18/60	1-1/2	Dry	Dry	20-1/2	4-1/2	Dry	Dry	17	15	8	11	4	6	1	Dry	19	11-1/2	14-1/2	3	5	7-1/2	9	20	11-1/2	+?
3/19/60	2	Dry	Dry	22	5	Dry	Dry	19	14-1/2	11	14-1/2	4	7-1/2	1/2	Dry	21	13	16-1/2	5	13	10	8	22	13	+?
3/21/60	3	Dry	Dry	Dry	6-1/2	Dry	Dry	Dry	16	18	20-1/2	8-1/2	11-1/2	1	Dry	24-1/2	15-1/2	20	18-1/2	Dry	15	13	24	15-1/2	5-1/2
3/22/60	3	Dry	Dry	Dry	6	Dry	Dry	Dry	16-1/2	19-1/2	22-1/2	17	12-1/2	1-1/2	Dry	28	16	Dry	20-1/2	Dry	16-1/2	13-1/2	25	17	10-1/2
3/23/60	4	Dry	Dry	Dry	4-1/2	Dry	Dry	Dry	15	19	25	18	14	1-1/2	Dry	Dry	15	Dry	23-1/2	Dry	16-1/2	14	26	17-1/2	12-1/2
3/24/60	4	Dry	Dry	Dry	5	Dry	Dry	Dry	15	19-1/2	27	19-1/2	14-1/2	2	Dry	Dry	15-1/2	Dry	25	Dry	18	15-1/2	26-1/2	18-1/2	13
3/25/60	3-1/2	Dry	Dry	23-1/2	3	Dry	Dry	15	14	8	19	6	8	1	Dry	Dry	8	14	6	12	9	8	23	12-1/2	11
3/26/60	3	Dry	Dry	Dry	4	Dry	Dry	17-1/2	13	10-1/2	21	5-1/2	10	2	Dry	Dry	10	16	6-1/2	14	10-1/2	11	24	14	13
3/28/60	2-1/2	Dry	Dry	Dry	2-1/2	Dry	Dry	18	11-1/2	4-1/2	19-1/2	5-1/2	7-1/2	1/2	Dry	11	7-1/2	10-1/2	1/2	9	6	4-1/2	20-1/2	11-1/2	12-1/2
3/29/60	2-1/2	Dry	Dry	Dry	3	Dry	Dry	20	10	4-1/2	22	3	9	+1/2	Dry	16	8-1/2	12-1/2	1-1/2	9-1/2	7-1/2	6	21-1/2	12-1/2	13-1/2
3/30/60	2-1/2	Dry	Dry	Dry	4-1/2	Dry	Dry	22	10	9	25	2-1/2	11	+1	Dry	9	7	9	0	9	5	2-1/2	20	11	12-1/2
3/31/60	2-1/2	Dry	Dry	Dry	7	Dry	Dry	Dry	10	13	27-1/2	5-1/2	13	0	Dry	15	10	13-1/2	4-1/2	12	10-1/2	8	22-1/2	14-1/2	14

(Continued)

Note: +2 = water standing 2 in. aboveground.
+? = water standing aboveground but height unknown.
0 = water table at ground surface.
Dry = well dry.

(1 of 3 sheets)

Table 11 (Continued)

Date	Depth to Water Table, in. W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21	W22	W23	W24	W25
4/2/60	3	Dry	Dry	Dry	8	Dry	Dry	Dry	13	19-1/2	33	17	16-1/2	1-1/2	Dry	21	13-1/2	18	19	Dry	15-1/2	12-1/2	25	17-1/2	16
4/4/60	4	Dry	Dry	Dry	12	Dry	Dry	Dry	16	22	38	23	19-1/2	3	Dry	24-1/2	16-1/2	Dry	26	Dry	Dry	17	28	20	17-1/2
4/5/60	5	Dry	Dry	Dry	14	Dry	Dry	Dry	18	24	41-1/2	26	22	4-1/2	Dry	26	18	Dry	29-1/2	Dry	Dry	19	29-1/2	21-1/2	18-1/2
4/6/60	7	Dry	Dry	Dry	15	Dry	Dry	Dry	20	24-1/2	Dry	26	24	4-1/2	Dry	Dry	19	Dry	31	Dry	Dry	20-1/2	30-1/2	22-1/2	19
4/8/60	10-1/2	Dry	Dry	Dry	17	Dry	Dry	Dry	23-1/2	27	Dry	Dry	Dry	7	Dry	Dry	21-1/2	Dry	36	Dry	Dry	23	32-1/2	24-1/2	21
4/11/60	13	Dry	Dry	Dry	17	Dry	Dry	Dry	29	30	Dry	Dry	Dry	9-1/2	Dry	Dry	24	Dry	Dry	Dry	Dry	29	35-1/2	27	22-1/2
4/12/60	14	Dry	Dry	Dry	17	Dry	Dry	Dry	30	31	Dry	Dry	Dry	10	Dry	Dry	24-1/2	Dry	Dry	Dry	Dry	31	Dry	Dry	23-1/2
4/13/60	14	Dry	Dry	Dry						31-1/2	Dry														
4/15/60																							Dry	Dry	26
4/18/60	17-1/2	Dry	Dry	Dry	20	Dry	Dry	Dry		36-1/2	Dry														
4/19/60												Dry	Dry	17	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
4/20/60									38	38	Dry														
4/21/60														8	Dry	Dry	Dry	Dry	Dry	Dry	15	Dry	Dry	23	23-1/2
4/22/60	15	Dry	Dry	Dry	14	Dry	Dry	Dry	39-1/2	39	Dry														
4/25/60	16	Dry	Dry	Dry	19	Dry	Dry	Dry	41-1/2	40	Dry														
4/26/60	16-1/2	Dry	Dry	Dry	20-1/2	Dry	Dry	Dry	42-1/2	40-1/2	Dry	Dry	Dry	14	Dry	Dry	Dry	Dry	Dry	13	16-1/2	Dry	Dry	25	28-1/2
4/27/60	15	Dry	Dry	Dry	16-1/2	Dry	Dry	Dry	44	39-1/2	Dry	Dry	Dry	10	Dry	Dry	Dry	Dry	27	7-1/2	11	Dry	35-1/2	19	19
4/28/60														12-1/2	Dry	Dry	Dry	Dry	31	11	15-1/2	Dry	33-1/2	21	
4/29/60	15	Dry	Dry	Dry	18-1/2	Dry	Dry	Dry	44-1/2	39	Dry														
5/2/60														20	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	26-1/2	24-1/2
5/3/60	17-1/2	Dry	Dry	Dry	24	Dry	Dry	Dry	47-1/2	38	Dry													Dry	26
5/4/60																								Dry	28-1/2
5/6/60	16-1/2	Dry	Dry	Dry	16-1/2	Dry	Dry	Dry	37	34	Dry	24	23-1/2	+12	7-1/2	8-1/2	7-1/2	4-1/2	14	2	3	Dry	23-1/2	3-1/2	5-1/2
5/9/60	16-1/2	Dry	Dry	Dry	18	Dry	Dry	Dry	38	26	Dry	Dry	Dry	2-1/2	Dry	23-1/2	20	Dry	29	Dry	Dry	Dry	27-1/2	20	
5/10/60	17-1/2	Dry	Dry	Dry	21	Dry	Dry	Dry	39-1/2	27-1/2	Dry			7-1/2	Dry	Dry	22-1/2	Dry	36-1/2	Dry	Dry	Dry	31	25	12
5/11/60	20	Dry	Dry	Dry	27-1/2	Dry	Dry	Dry	42-1/2	32-1/2	Dry														
5/12/60																								27	15-1/2
5/13/60	20	Dry	Dry	Dry	27-1/2	Dry	Dry	Dry	42-1/2	32-1/2	Dry														
5/16/60	23-1/2	Dry	Dry	Dry	31-1/2	Dry	Dry	Dry	44	36	Dry														
5/17/60	24	Dry	Dry	Dry	32	Dry	Dry	Dry		37	Dry														
5/18/60										39-1/2															
5/19/60														25-1/2	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
5/20/60		Dry	Dry	Dry	35-1/2	Dry	Dry	Dry		Dry	Dry														
5/23/60	28-1/2	Dry	Dry	Dry	36	Dry	Dry	Dry		Dry	Dry														
6/2/60														Dry	Dry	Dry	Dry	Dry	38	12	Dry	Dry	Dry	Dry	Dry
6/6/60	Dry				Dry																				
6/7/60									40											Dry	Dry					
Measurements stopped 6/16/60, started again 11/23/60																									
11/23/60	Dry	Dry	Dry	Dry	35	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	9	Dry	Dry	Dry	Dry	Dry	9	Dry	Dry	Dry	22	Dry
11/25/60	Dry	Dry	Dry	Dry	34	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	26-1/2	Dry	Dry	Dry	Dry	Dry	15-1/2	Dry	Dry	Dry	27	Dry
11/28/60	Dry	Dry	Dry	Dry	34	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	33	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
11/30/60	Dry	Dry	Dry	Dry	27-1/2	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	35-1/2	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
12/2/60	Dry	Dry	Dry	Dry	28	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
12/5/60	Dry	Dry	Dry	Dry	26-1/2	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
12/7/60	2	Dry	Dry	Dry	+1/2	Dry	24-1/2	Dry	Dry	24	Dry	15	Dry	27	Dry	Dry	Dry	Dry	Dry	1-1/2	14	Dry	Dry	11-1/2	Dry
12/9/60	2	Dry	Dry	Dry	+1/2	Dry	Dry	Dry	Dry	13-1/2	Dry	6	Dry	13-1/2	Dry	Dry	20-1/2	Dry	Dry	1-1/2	9-1/2	Dry	Dry	17	Dry
12/12/60	3-1/2	Dry	Dry	Dry	6	Dry	Dry	Dry	Dry	11	Dry	5	Dry	19	Dry	Dry	18	Dry	Dry	10	12	Dry	Dry	21-1/2	Dry
12/14/60	8	Dry	Dry	Dry	7	Dry	Dry	Dry	Dry	14	Dry	5	Dry	23	Dry	Dry	21	Dry	Dry	17	16	Dry	Dry	24	Dry
12/16/60	7	Dry	Dry	Dry	7	Dry	Dry	Dry	Dry	10	Dry	6-1/2	Dry	24	Dry	Dry	21-1/2	Dry	Dry	17	12	Dry	Dry	23	26
12/19/60	12	Dry	Dry	Dry	11-1/2	Dry	Dry	Dry	Dry	17	Dry	7	Dry	26	Dry	Dry	22	Dry	Dry	Dry	Dry	Dry	Dry	26	28
12/21/60	14	Dry	Dry	Dry	13	Dry	Dry	Dry	Dry	19	Dry	10	Dry	30	Dry	Dry	24	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
12/23/60	16	Dry	Dry	Dry	14	Dry	Dry	Dry	Dry	22	Dry	20	Dry	31	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
12/27/60	17-1/2	Dry	Dry	Dry	14	Dry	Dry	Dry	Dry	23	Dry	22	Dry	33	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
12/28/60	17	Dry	Dry	Dry	8-1/2	Dry	Dry	Dry	Dry	22-1/2	Dry	22	Dry	33-1/2	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
12/30/60	2-1/2	38	Dry	18	0	Dry	Dry	13	Dry	1	Dry	4	Dry	2	36-1/2	23	8	19	16-1/2	2-1/2	7	Dry	Dry	15	+1

(Continued)

Table 11 (Concluded)

Date	Depth to Water Table, in. W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21	W22	W23	W24	W25
1/3/61	1-1/2	36	Dry	20	1-1/2	Dry	Dry	16	Dry	5	Dry	3-1/2	22-1/2	2	Dry	Dry	11-1/2	Dry	21	11	11	Dry	34-1/2	16	+?
1/4/61	1-1/2	37-1/2	Dry	21	2-1/2	Dry	Dry	18	Dry	7	Dry	3	24-1/2	3	Dry	Dry	12-1/2	Dry	25	14	12-1/2	Dry	35	17-1/2	+?
1/6/61	1	39-1/2	Dry	23-1/2	4	Dry	Dry	21	Dry	9	Dry	3-1/2	Dry	5	Dry	Dry	14-1/2	Dry	31-1/2	Dry	16	Dry	Dry	19-1/2	+?
1/9/61	1	Dry	Dry	21	4	Dry	Dry	16	Dry	2	Dry	3-1/2	22	5	Dry	Dry	10	21	13	9-1/2	9	Dry	34	15	10-1/2
1/11/61	1	Dry	Dry	Dry	5	Dry	Dry	19	Dry	6	Dry	3-1/2	24	6	Dry	Dry	12	Dry	24	15-1/2	13-1/2	Dry	35	18	13
1/13/61	1	Dry	Dry	Dry	3-1/2	Dry	Dry	Dry	Dry	6	Dry	3-1/2	Dry	8	Dry	Dry	13	Dry	28-1/2	Dry	16	Dry	Dry	19	14
1/16/61	1	Dry	Dry	Dry	4	Dry	Dry	Dry	Dry	1	Dry	3	22	10	Dry	Dry	13	Dry	36-1/2	Dry	15	Dry	Dry	19	14-1/2
1/18/61	1-1/2	Dry	Dry	Dry	7-1/2	Dry	Dry	Dry	Dry	5	Dry	3	Dry	11	Dry	Dry	15-1/2	Dry	Dry	Dry	Dry	Dry	Dry	21	16
1/20/61	1	Dry	Dry	Dry	6	Dry	Dry	Dry	Dry	3	Dry	3	24	11	Dry	Dry	13	Dry	Dry	Dry	18	Dry	Dry	20-1/2	16
1/23/61	2-1/2	Dry	Dry	Dry	10	Dry	Dry	Dry	Dry	11	Dry	3	Dry	13-1/2	Dry	Dry	16-1/2	Dry	Dry	Dry	Dry	Dry	Dry	23	18
1/25/61	3-1/2	Dry	Dry	Dry	10	Dry	Dry	Dry	Dry	10-1/2	Dry	3	Dry	14-1/2	Dry	Dry	17-1/2	Dry	Dry	Dry	Dry	Dry	Dry	23-1/2	19
1/27/61	2-1/2	Dry	Dry	Dry	9	Dry	Dry	Dry	Dry	7	Dry	3	Dry	15	Dry	Dry	17-1/2	Dry	Dry	Dry	Dry	Dry	Dry	22-1/2	19
1/30/61	2-1/2	Dry	Dry	Dry	9	Dry	Dry	Dry	Dry	11-1/2	Dry	3	Dry	17	Dry	Dry	19	Dry	Dry	Dry	Dry	Dry	Dry	24-1/2	20-1/2
2/1/61	1	Dry	Dry	Dry	6-1/2	Dry	Dry	Dry	Dry	11-1/2	Dry	3-1/2	Dry	16	Dry	Dry	19-1/2	Dry	Dry	Dry	Dry	Dry	Dry	25	21
2/3/61	1	Dry	Dry	Dry	5	Dry	Dry	Dry	Dry	6	Dry	3-1/2	Dry	15	Dry	Dry	13-1/2	Dry	Dry	Dry	15	Dry	Dry	21	18
2/6/61	1-1/2	Dry	Dry	Dry	7-1/2	Dry	Dry	Dry	Dry	8-1/2	Dry	3	Dry	14	Dry	Dry	14	Dry	Dry	Dry	16-1/2	Dry	Dry	22-1/2	19
2/8/61	1	Dry	Dry	Dry	4-1/2	Dry	Dry	Dry	Dry	0	Dry	3	20-1/2	6-1/2	Dry	20	9	18	10	5	8	Dry	33	13-1/2	13-1/2
2/10/61	1	Dry	Dry	Dry	7	Dry	Dry	Dry	Dry	4-1/2	Dry	3	22-1/2	8	Dry	26	11	Dry	20-1/2	12	11-1/2	Dry	33-1/2	16-1/2	16
2/13/61	2	Dry	Dry	Dry	10	Dry	Dry	Dry	Dry	9-1/2	Dry	3	Dry	10-1/2	Dry	Dry	12-1/2	Dry	30	17	18	Dry	Dry	19	16
2/15/61	3-1/2	Dry	Dry	Dry	11-1/2	Dry	Dry	Dry	Dry	13	Dry	3	Dry	12	Dry	Dry	14-1/2	Dry	35-1/2	Dry	Dry	Dry	Dry	21	19
2/17/61	2-1/2	Dry	Dry	Dry	2-1/2	Dry	Dry	10	Dry	+1	Dry	5	2-1/2	+1	30	6-1/2	2-1/2	3-1/2	29	3	13	Dry	Dry	5	5-1/2
2/18/61	1-1/2	Dry	Dry	18-1/2	2	Dry	26	11-1/2	Dry	+2-1/2	18	7-1/2	1-1/2	+12-1/2	12	7-1/2	5-1/2	14	3	1/2	3-1/2	12	20	2	6
2/20/61	1/2	42	0	7	1-1/2	15	13	5	Dry	+3	1-1/2	6-1/2	0	+2	9	5-1/2	5-1/2	3	2	1/2	2-1/2	6	17	+1/2	+?
2/21/61	1/2	29	3-1/2	12	1-1/2	12	19	9-1/2	Dry	+2-1/2	2	3	+1/2	+?	4	6	6	3	2	1/2	1	1	5-1/2	0	+?
2/24/61	1	28-1/2	Dry	19	3	Dry	Dry	16	52	1	8	3	4	+1-1/2	35	22	10	13	5	6-1/2	6-1/2	7	19	11	+?
2/27/61	1	31	Dry	21	5-1/2	Dry	Dry	17	46	3	13	3	6	+1-1/2	Dry	25	11	16	10	13	10	13-1/2	22	14	+?

(3 of 3 sheets)

Table 12

First Occurrence of Water Tables in Wells

	1959-60 Wet Season	Cumulative Rainfall, in.				1960-61 Wet Season	Cumulative Rainfall, in.			
Site No.	Date Water Table First Occurred	From 1 Oct to Date Water Table First Occurred	Preceding First Occurrence of Water Table: 1 Day	2 Days	4 Days	Date Water Table First Occurred	From 1 Oct to Date Water Table First Occurred	Preceding First Occurrence of Water Table: 1 Day	2 Days	4 Days
MS10, MS11	11/4/59	3.70	0.95	1.90	1.90	11/9/60	4.00	1.50	1.50	1.50
MS2, MS3	11/4/59	4.55	0.55	1.70	1.70	11/9/60	4.60	1.20	1.65	1.65
MS4	12/10/59	5.75	0.20	0.20	0.20	11/15/60	5.80	1.20	1.20	1.20
MS1	12/11/59	6.60	0.85	1.05	1.05	12/6/60	10.40	2.10	3.55	3.55
MS6	12/11/59	6.60	0.85	1.05	1.05	11/9/60	4.60	1.20	1.65	1.65
W10	12/15/59	7.40	0.80	0.80	0.80	12/6/60	10.40	2.10	3.55	3.55
MS12	12/16/59	7.70	1.70	2.25	2.25	12/6/60	7.60	0.25	1.10	1.10
MS9	12/16/59	9.20	1.30	2.20	2.20	12/8/60	10.60	0.60	1.10	2.90
W5	12/27/59	9.05	0.50	0.50	0.50	11/22/60	6.15	0.35	0.35	0.35
W14, W20, W24	1/5/60	11.30	1.30	1.40	1.40	11/17/60	7.70	2.35	3.15	3.15
W21	1/5/60	11.30	1.30	1.40	1.40	12/6/60	9.50	0.80	1.80	1.80
W25	1/5/60	11.30	1.30	1.40	1.40	12/14/60	11.65	0.30	0.30	0.30
MS7	1/5/60	10.70	1.05	1.05	1.15	12/6/60	10.40	2.10	3.55	3.55
MS8	1/5/60	10.70	1.05	1.05	1.15	12/7/60	10.90	0.50	2.60	4.05
W17	1/13/60	1[illegible].55	0.25	0.25	0.25	12/8/60	10.60	0.60	1.10	2.90
W1, W12	1/16/60	11.70	0.85	0.85	1.00	12/6/60	10.40	2.10	3.55	3.55
W9	1/16/60	11.70	0.85	0.85	1.00	2/24/61	26.50	0.50	0.50	0.50
W19	1/16/60	12.60	0.80	0.80	1.30	12/28/60	13.30	1.50	1.65	1.65
W22	1/26/60	13.65	1.05	1.05	1.05	2/17/61	20.15	1.15	1.90	1.90
W23	1/26/60	13.65	1.05	1.05	1.05	12/31/60	15.20	0.45	1.45	3.40
W13	2/3/60	14.40	1.05	1.05	1.05	12/31/60	17.20	0.40	1.40	4.25
W15	2/24/60	16.85	1.40	1.40	1.40	12/28/60	13.30	1.50	1.65	1.65
W16, W18	2/24/60	16.85	1.40	1.40	1.40	12/29/60	13.75	0.45	1.95	2.10
W3	2/24/60	17.40	1.60	1.60	1.60	2/20/61	25.55	1.90	4.15	5.45
W7	2/24/60	17.40	1.60	1.60	1.60	2/19/61	23.65	2.25	2.45	3.55
W4, W8	2/24/60	17.40	1.60	1.60	1.60	12/28/60	15.65	2.70	2.90	2.90
W11	2/24/60	17.40	1.60	1.60	1.60	2/18/61	21.40	0.20	1.30	2.00
W2		No water table				12/28/60	15.65	2.70	2.90	2.90
MS5		No water table					No water table*			
W6		No water table				2/20/61	25.55	1.90	4.15	5.45
Avg all sites		11.30					12.40			

* Considered as a site with no water table although water was observed in well on two days after very heavy rainfall.

Table 13

First Occurrence of Water Tables Within Surface Foot

Site No.	1959-60 Wet Season: Date Water Table First Occurred Within Surface Foot	1959-60 Cumulative Rainfall, in.: From 1 Oct to Date Water Table First Occurred Within Surface Foot	1959-60 Preceding First Occurrence of Water Table Within Surface Foot: 1 Day	2 Days	4 Days	1960-61 Wet Season: Date Water Table First Occurred Within Surface Foot	1960-61 Cumulative Rainfall, in.: From 1 Oct to Date Water Table First Occurred Within Surface Foot	1960-61 Preceding First Occurrence Of Water Table Within Surface Foot: 1 Day	2 Days	4 Days
MS2	11/13/59	5.15	0.60	0.60	0.60	11/22/60	6.15	0.35	0.35	0.35
MS10	12/11/59	5.45	0.75	0.75	0.75	12/5/60	7.35	0.85	0.85	0.85
MS11	12/16/59	7.70	1.70	2.25	2.25	12/6/60	7.60	0.25	1.10	1.10
MS1	12/16/59	8.45	1.05	1.85	1.85	12/8/60	11.50	0.60	1.10	4.65
MS3	12/16/59	8.45	1.05	1.85	1.85	11/22/60	6.15	0.35	0.35	0.35
MS4	12/16/59	8.45	1.05	1.85	1.85	11/28/60	6.85	0.70	0.70	0.70
MS6	12/16/59	8.45	1.05	1.85	1.85	12/6/60	10.40	2.10	3.55	3.55
MS7	1/5/60	10.70	1.05	1.05	1.05	12/6/60	10.40	2.10	3.55	3.55
MS8	1/5/60	10.70	1.05	1.05	1.05	12/7/60	10.90	0.50	2.60	4.05
W14, W20	1/5/60	11.30	1.30	1.40	1.40	11/18/60	7.70	2.35	3.15	3.15
W21, W24	1/5/60	11.30	1.30	1.40	1.40	12/8/60	10.60	0.60	1.10	1.90
MS9	1/14/60	11.80	0.25	0.50	0.50	12/31/60	15.20	0.45	1.45	3.40
W5	1/16/60	11.70	0.85	0.85	1.00	12/6/60	10.40	2.10	3.55	3.55
W12	1/16/60	11.70	0.85	0.85	1.00	12/8/60	11.50	0.60	1.10	4.65
MS12	1/26/60	12.15	1.15	1.15	1.15	12/30/60	12.85	1.70	1.95	1.95
W1	1/26/60	12.75	1.05	1.05	1.05	12/6/60	10.40	2.10	3.55	3.55
W19	1/26/60	13.65	1.05	1.05	1.05	12/30/60	14.75	1.00	1.45	3.10
W17, W25	1/28/60	14.05	0.40	0.40	1.45	12/30/60	14.75	1.00	1.45	3.10
W10	2/4/60	14.85	0.45	1.50	1.50	12/7/60	10.90	0.50	2.60	4.05
W16	2/24/60	16.85	1.40	1.40	1.40	2/17/61	20.15	1.15	1.90	1.90
W18	2/24/60	16.85	1.40	1.40	1.40	2/16/61	19.00	0.75	0.75	0.75
W22	2/24/60	16.85	1.40	1.40	1.40	2/20/61	23.55	2.65	3.30	4.55
W8	2/25/60	17.40	1.60	1.60	1.60	12/30/60	16.80	1.00	1.15	4.05
W13	2/25/60	17.40	1.60	1.60	1.60	2/16/61	20.10	0.70	0.70	0.70
W3	3/1/60	18.85	1.45	1.45	1.45	2/20/61	25.55	1.90	4.15	5.45
W4	3/1/60	18.85	1.45	1.45	1.45	2/18/61	21.40	0.20	1.30	2.00
W15	3/2/60	18.75	0.25	1.75	1.90	2/19/61	20.90	0.65	0.75	1.90
W11	3/3/60	19.30	0.45	0.45	1.90	2/19/61	23.65	2.25	2.45	4.25
W9	3/27/60	21.55	0.20	0.20	0.55		No water table			
W6		No water table				2/21/61	26.00	0.45	2.35	4.80
W23		No water table				2/20/61	23.55	2.65	3.30	4.55
W2, W7, MS5		No water table					No water table			
Avg all sites		13.10					14.30			

Table 14

Cumulative Rainfall Required to Initiate Water Tables in Wells

Site No.	Topographic Position	1959-60 Date Water Table First Occurred	1959-60 Cumulative Rainfall* in.	1960-61 Date Water Table First Occurred	1960-61 Cumulative Rainfall* in.	Average Date Water Table First Occurred	Average Cumulative Rainfall* in.
				Upland Position			
MS5	Upland flat	**	--	†	--	--	--
W11	Upland flat	2/24/60	17.40	2/18/61	21.40	2/21	19.40
W13	Upland flat	2/3/60	14.40	12/31/60	17.20	1/17	15.80
W12	Upland flat	1/16/60	11.70	12/6/60	10.40	12/26	11.05
MS7	Upland flat	1/5/60	10.70	12/6/60	10.40	12/21	10.55
W24	Upland flat	1/5/60	11.30	11/17/60	7.70	12/11	9.50
W10	Upland flat	12/15/59	7.40	12/6/60	10.40	12/10	8.90
MS12	Upland flat	12/16/59	7.70	12/6/60	7.60	12/11	7.65
MS10	Upland flat	11/4/59	3.70	11/9/60	4.00	11/7	3.85
MS11	Upland flat	11/4/59	3.70	11/9/60	4.00	11/7	3.85
					Avg	12/18	10.01
				Slope Positions			
W4	Crest of slope	2/24/60	17.40	12/28/60	15.65	1/26	16.52
W8	Crest of slope	2/24/60	17.40	12/28/60	15.65	1/26	16.52
W18	Crest of slope	2/24/60	16.85	12/29/60	13.75	1/27	15.30
W23	Crest of slope	1/26/60	13.65	12/31/60	15.20	1/13	14.42
					Avg	1/23	15.69
W3	U[illegible]r slope	2/24/60	17.40	2/20/61	25.55	2/22	21.47
W7	[illegible]pper slope	2/24/60	17.40	2/19/61	23.65	2/22	20.52
W22	Upper slope	1/26/60	13.65	2/17/61	20.15	2/6	16.90
W17	Upper slope	1/13/60	11.55	12/8/60	10.60	12/26	11.08
					Avg	2/4	17.53
W6	Midslope	**	--	2/20/61	25.55	--	25.55
W2	Midslope	**	--	12/28/60	15.65	--	15.65
W16	Midslope	2/24/60	16.85	12/29/60	13.75	1/27	15.30
W21	Midslope	1/5/60	11.30	12/6/60	9.50	12/21	10.40
					Avg	1/9	16.72
				Avg of all slope positions			16.65
				Low-Lying Positions††			
W15	Bottom of slope	2/24/60	16.85	12/28/60	13.30	2/26	15.08
W19	Bottom of slope	1/16/60	12.60	12/28/60	13.30	1/7	12.95
W1	Bottom of slope	1/16/60	11.70	12/6/60	10.40	12/26	11.05
W20	Bottom of slope	1/5/60	11.30	11/17/60	7.70	12/12	9.50
W14	Bottom of slope	1/5/60	11.30	11/17/60	7.70	12/12	9.50
MS1	Bottom of slope	12/11/59	6.60	12/6/60	10.40	12/8	8.50
W5	Bottom of slope	12/27/59	9.05	11/22/60	6.15	12/10	7.60
MS6	Bottom of slope	12/11/59	6.60	11/9/60	4.60	11/25	5.60
					Avg	12/24	9.97
W25	Minor bottomland	1/5/60	11.30	12/14/60	11.65	12/25	11.48
MS8	Minor bottomland	1/5/60	10.70	12/7/60	10.90	12/22	10.80
MS9	Minor bottomland	12/16/59	9.20	12/8/60	10.60	12/12	9.90
					Avg	12/20	10.73
		Avg of bottom of slope and minor bottomland positions					10.35
MS4	Major bottomland	12/10/59	5.75	11/15/60	5.80	11/28	5.78
MS2	Major bottomland	11/4/59	4.55	11/9/60	4.60	11/7	4.58
MS3	Major bottomland	11/4/59	4.55	11/9/60	4.60	11/7	4.58
					Avg	11/14	4.98

* From 1 October to first occurrence of water table (from table 12).
** No water table.
† Considered as a site with no water table, although water was observed in well on two days after very heavy rainfall.
†† Site W9 was not considered here because water level at this site depends upon stage of Ouachita River rather than local rainfall (see paragraph 72 and plate 16).

Table 15

Cumulative Rainfall Required to Raise Water Tables Within Surface Foot

Site No.	Topographic Position	1959-60 Date Water Table First Occurred Within Surface Foot	1959-60 Cumulative Rainfall* in.	1960-61 Date Water Table First Occurred Within Surface Foot	1960-61 Cumulative Rainfall* in.	Average Date Water Table First Occurred Within Surface Foot	Average Cumulative Rainfall* in.
				Upland Position			
W11	Upland flat	3/3/60	19.30	2/19/61	23.65	2/25	21.45
W13	Upland flat	2/25/60	17.40	2/16/61	20.10	2/20	18.75
W10	Upland flat	2/4/60	14.85	12/7/60	10.90	1/5	12.88
MS12	Upland flat	1/26/60	12.15	12/30/60	12.85	1/12	12.50
W12	Upland flat	1/16/60	11.70	12/8/60	11.50	12/28	11.60
W24	Upland flat	1/5/60	11.30	12/8/60	10.60	12/22	10.95
MS7	Upland flat	1/5/60	10.70	11/6/60	10.40	12/6	10.55
MS11	Upland flat	12/16/59	7.70	12/6/60	7.60	12/11	7.65
MS10	Upland flat	12/11/59	5.45	12/5/60	7.35	12/8	6.40
MS5	Upland flat	**	--	**	--	--	--
					Avg	1/5	12.53
				Slope Positions			
W23	Crest of slope	**	--	2/20/61	23.55	--	23.55
W4	Crest of slope	3/1/60	18.85	2/18/61	21.40	2/24	20.12
W18	Crest of slope	2/24/60	16.85	2/16/61	19.00	2/20	17.92
W8	Crest of slope	2/25/60	17.40	12/30/60	16.80	1/27	17.10
					Avg		19.67
W7	Upper slope	**	--	**	--	--	--
W3	Upper slope	3/1/60	18.85	2/20/61	25.55	2/24	22.20
W22	Upper slope	2/24/60	16.85	2/20/61	23.55	2/22	20.20
W17	Upper slope	1/28/60	14.05	12/30/60	14.75	1/14	14.40
					Avg	2/9	18.93
W2	Midslope	**	--	**	--	--	--
W6	Midslope	**	--	2/21/61	26.00		26.00
W16	Midslope	2/24/60	16.85	2/17/61	20.15	2/20	18.50
W21	Midslope	1/5/60	11.30	12/8/60	10.60	12/22	10.95
					Avg		18.48
				Avg of all slope positions			19.02
				Low-Lying Positions†			
W15	Bottom of slope	3/2/60	18.75	2/19/61	20.90	2/24	19.82
W19	Bottom of slope	1/26/60	13.65	12/30/60	14.75	1/13	14.20
W1	Bottom of slope	1/26/60	12.75	12/6/60	10.40	1/1	11.58
W5	Bottom of slope	1/16/60	11.70	12/6/60	10.40	12/26	11.05
MS1	Bottom of slope	12/16/59	8.45	12/8/60	11.50	12/12	9.98
W14	Bottom of slope	1/5/60	11.30	11/18/60	7.70	12/12	9.50
W20	Bottom of slope	1/5/60	11.30	11/18/60	7.70	12/12	9.50
MS6	Bottom of slope	12/16/59	8.45	11/6/60	10.40	11/26	9.42
					Avg	12/28	11.88
W25	Minor bottomland	1/28/60	14.05	12/30/60	14.75	1/13	14.40
MS9	Minor bottomland	1/14/60	11.80	12/31/60	15.20	1/7	13.50
MS8	Minor bottomland	1/5/60	10.70	12/7/60	10.90	12/22	10.80
					Avg	1/4	12.90
		Avg of bottom of slope and minor bottomland positions					12.39
MS4	Major bottomland	12/16/59	8.45	11/28/60	6.85	12/7	7.65
MS3	Major bottomland	12/16/59	8.45	11/22/60	6.15	12/4	7.30
MS2	Major bottomland	11/13/59	5.15	11/22/60	6.15	11/18	5.65
					Avg	11/30	6.67

* From 1 October to first occurrence of water in surface foot (from table 13).

** No water table.

† Site W9 was not considered here because water level at this site depends upon stage of Ouachita River rather than on local rainfall (see paragraph 72 and plate 16).

Table 16

Duration of Water Tables, Sites Grouped by Topographic Position

Site No.	Topographic Position	Duration of Water Table, % — Within Surface Foot	Duration of Water Table, % — In Well
	Upland Position		
MS5	Upland flat	0	0
W11	Upland flat	3	19
W13	Upland flat	15	28
MS7	Upland flat	30	32
W12	Upland flat	24	36
W24	Upland flat	13	48
W10	Upland flat	13	69
MS12	Upland flat	25	69+
MS11	Upland flat	34	91+
MS10	Upland flat	51	92+
	Avg	21	48+
	Slope Positions		
W4	Crest of slope	0	12
W8	Crest of slope	3	15
W18	Crest of slope	6	17
W23	Crest of slope	0	35
	Avg	2	20
W7	Upper slope	0	4
W3	Upper slope	0	5
W22	Upper slope	14	31
W17	Upper slope	17	45
	Avg	8	21
W6	Midslope	0	0
W2	Midslope	0	0
W16	Midslope	4	16
W21	Midslope	22+	33+
	Avg	6+	12+
	Avg of slope positions	5+	18+

Site No.	Topographic Position	Duration of Water Table, % — Within Surface Foot	Duration of Water Table, % — In Well
	Low-Lying Positions		
W15	Bottom of slope	1	8
W20	Bottom of slope	14	24
W19	Bottom of slope	19	38
W1	Bottom of slope	33	58+
W14	Bottom of slope	34+	59+
W5	Bottom of slope	28	66+
MS1	Bottom of slope	49	73
MS6	Bottom of slope	54	73
	Avg	29+	50+
W25	Minor bottomland	23	59+
MS8	Minor bottomland	34	61
MS9	Minor bottomland	23	77
	Avg	27	66+
	Avg bottom of slope and minor bottom-land	28+	58+
MS4	Major bottomland	64	81+
MS3	Major bottomland	71+	92+
MS2	Major bottomland	72+	97+
	Avg	69+	90+

Note: A plus sign indicates that a water table was present when measurements began, so duration is somewhat greater than that indicated.

Table 17

Durations of Water Tables at Low-Lying Positions for Units of Slope

Site No.		Slope, %	Duration of Water Table, % Within Surface Foot	In Well
MS2		0	72+	97+
MS3		0	71+	92+
MS4		0	64	81+
MS8		0	34	61
W25		0	23	59+
	Avg	0	53+	78+
MS1		1	49	73
MS6		1	54	73+
MS9		1	23	77
	Avg	1	42	74+
W14		2	34+	59+
W1		4	33	58+
W19		5	19	38
W5		6	28	66+
W20		11	14	24

Note: A plus sign indicates that a water table was present when measurements began, so duration is somewhat greater than that indicated.

Table 18

Duration of Water Tables Within Surface Foot and Depth to a Relatively Impermeable Layer for Sites on Slope Position

Site No.	Depth to Relatively Impermeable Layer* in.	Duration of Water Table Within Surface Foot** %
	Crest of Slope	
W4	36	0
W8	30	3
W18	21	6
W23	35	0
	Upper Slope	
W3	12	0
W7	†	0
W17	24	17
W22	25	14
	Midslope	
W2	†	0
W6	6	0
W16	27	4
W21	19	22+

Note: A plus sign indicates that a water table was present when measurements began, so duration is somewhat greater than that indicated.
* From table 3.
** From table 16.
† No impermeable layer.

Table 19

Effective Rainfall Indexes

Topographic Position	Cumulative Rainfall, in., Required to Initiate Water (1) In Well*	(2) In Sfc** ft	Available Storage Capacity of Soil, in., from Sfc to 4 ft or Top of Relatively Impermeable Layer† (3) In Small Pores††	(4) In All Pores‡	Ratios of Storage Capacity to Cumulative Rainfall (5) (3) ÷ (1)	(6) (4) ÷ (2)	(7) Avg of (5) + (6)	Effective Rainfall Index (ERI)‡‡ (8) $(7) \times \frac{1}{0.625}$
Upland position								
Upland flat								
(MS sites 5, 7, 10-12; W sites 10-13, 24)	10.01	12.53	6.0	8.2	0.60	0.65	0.625	1.00
Slope positions								
Crest of slope								
(W sites 4, 8, 18, 23)	15.69	19.67	6.5	8.9	0.41	0.45	0.430	0.69
Upper slope								
(W sites 3, 7, 17, 22)	17.53	18.93	5.7	7.6	0.32	0.40	0.360	0.57
Midslope								
(W sites 2, 6, 16, 21)	16.72	18.48	4.6	6.2	0.28	0.34	0.310	0.50
Low-lying positions								
Bottom of slope								
(MS sites 1, 6; W sites 1, 5, 14, 15, 19, 20)	9.97	11.88	5.8	8.7	0.58	0.73	0.655	1.05
Minor bottomland								
(MS sites 8, 9; W site 25)	10.73	12.90	8.5	10.6	0.79	0.82	0.805	1.28
Major bottomland								
(MS sites 2-4)	4.98	6.87	10.7	14.1	2.14	2.05	2.095	3.35

* From table 14.
** From table 15.
† Estimated from data on depth to relatively impermeable layer in table 3 and data on soil moisture tension in table 6.
†† Pores that drain between 0.06- and 15-atm tension.
‡ Pores that drain between 0- and 15-atm tension.
‡‡ Average ratio of upland flat position (0.625) was adjusted to unity, and average ratios of all other topographic positions were adjusted proportionately.

Table 20

Rise (in.) of Water Tables for Topographic Positions

Rainfall in.	Midslope		Upper Slope		Crest of Slope		Upland Flat		Bottom of Slope		Minor Bottomland		Major Bottomland	
	WT Below 20 in.	WT Above 20 in.	WT Below 20 in.	WT Above 20 in.	WT Below 20 in.	WT Above 20 in.	WT Below 20 in.	WT Above 20 in.	WT Below 20 in.	WT Above 20 in.	WT Below 20 in.	WT Above 20 in.	WT Below 20 in.	WT Above 20 in.
0.1	0.6	1.2	0.7	1.4	0.9	1.7	1.2	2.5	1.3	2.6	1.6	3.2	4.2	8.4
0.2	1.2	2.5	1.4	2.3	1.7	3.4	2.5	5.0	2.6	5.2	3.2	6.4	8.4	16.7
0.3	1.9	3.8	2.1	4.3	2.6	5.2	3.8	7.5	3.9	7.9	4.8	9.6	12.6	>20.0
0.4	2.5	5.0	2.8	5.7	3.4	6.9	5.0	10.0	5.2	10.5	6.4	12.8	16.7	
0.5	3.1	6.2	3.6	7.1	4.3	8.6	6.2	12.5	6.6	13.1	8.0	16.0	20.9	
0.6	3.8	7.5	4.3	8.5	5.2	10.4	7.5	15.0	7.9	15.7	9.6	19.2	25.1	
0.7	4.4	8.8	5.0	10.0	6.1	12.1	8.8	17.5	9.2	18.4	11.2	>20.0	29.3	
0.8	5.0	10.0	5.7	11.4	6.9	13.8	10.0	20.0	10.5	>20.0	12.8		33.5	
0.9	5.6	11.2	6.4	12.8	7.8	15.5	11.2	>20.0	11.8		14.4			
1.0	6.2	12.5	7.1	14.2	8.6	17.2	12.5		13.1		16.0			
2.0	12.5	>20.0	14.2	>20.0	17.2	>20.0	25.0		26.2		32.0			
3.0	18.8		21.4		25.9									

Note: Derivation of values explained in paragraphs 77 and 78.
WT, water table.

Table 21

Daily Drawdown of Water Tables for Topographic Positions

Topographic Position	Mean Drawdown, in. Per Day During							
	Nov	Dec	Jan	Feb	March	April	May	June
Upland flat (MS sites 5, 7, 10-12; W sites 10-13, 24)	1.90	1.40	1.40	1.40	1.40	1.90	2.90	--
Crest of slope (W sites 4, 8, 18, 23)	Nc WT	No WT	No WT	1.60	1.75	2.25	2.90	--
Upper slope (W sites 3, 7, 17, 22)	No WT	0.90	1.00	1.15	1.45	2.30	3.50	--
Midslope (W sites 2, 6, 16, 21)	No WT	2.30	2.30	2.30	2.50	3.20	5.00	--
Bottom of slope (MS sites 1, 6; W sites 1, 5, 14, 15, 19, 20)	2.80	1.20	0.90	0.80	1.10	1.30	1.80	--
Minor bottomland (MS sites 8, 9; W site 25)	No WT	1.10	0.85	0.70	0.70	1.00	2.30	4.00
Major bottomland (MS sites 2-4)	1.10	1.10	0.70	0.40	0.20	0.90	1.80	4.00

Note: WT, water table.

Table 22

Water Table Prediction for Site M82

Date	Rainfall* in.	Drawdown: Days	Drawdown: Water Table** in.	Water Table Depth Before Rainfall, in.	Rise,† in.	Water Table Depth After Rainfall, in.
11/13/59	0.43††			>48		48.0
11/13/59	0.17			48.0	7.1	40.9
		13	14.3			
11/26/59	0.30			>48.0	12.6	35.4
		9	9.9			
12/5/59	0.10			45.3	4.2	41.1
		5	5.5			
12/10/59	0.20			46.6	8.4	38.2
		1	1.1			
12/11/59‡	0.85			39.3	35.6	3.7
		4	4.4			
12/15/59‡	0.80			8.1	20.0+	0
		1	1.1			
12/16/59‡	1.05			1.1	20.0+	0
		6	6.6			
12/22/59‡	0.10			6.6	8.4	0
		5	5.5			
12/27/59‡	0.50			5.5	20.0+	0
		4	4.4			
12/31/59‡	0.50			4.4	20.0+	0
		2	1.4			
1/2/60‡	0.10			1.4	8.4	0
		3	2.1			
1/5/60‡	1.05			2.1	20.0+	0
		9	6.3			
1/14/60‡	0.15			6.3	12.6	0
		2	1.4			
1/16/60‡	0.85			1.4	20.0+	0
		[illegible]	5.6			
1/24/60‡	0			5.6	--	--
		1	0.7			
1/25/60	0			6.3	--	--
		1	0.7			
1/26/60‡	1.05			7.0	20.0+	0
		2	1.4			
1/28/60‡	0.60			1.4	20.0+	0
		6	3.3			
2/3/60‡	1.05			3.3	20.0+	0
		1	0.4			
2/4/60‡	0.45			0.4	20.0+	0
		11	4.4			
2/15/60‡	0.15			4.4	12.6	0
		2	0.8			
2/17/60‡	0.35			0.8	20.0+	0
		3	1.2			
2/20/60‡	0.45			1.2	20.0+	0
		4	1.6			
2/24/60‡	1.60			1.6	20.0+	0
		6	2.2			

(Continued)

* From table 9.
** From table 21.
† From table 20.
†† The first 0.43 in. of rainfall on 13 Nov 1959 made the cumulative precipitation from 1 Oct 1959 total 4.98 in., the amount needed to initiate a water table at major bottomland sites (see table 14).
‡ Period when water table was above a depth of 6 in.

Table 22 (Concluded)

Date	Rainfall in.	Drawdown: Days	Drawdown: Water Table in.	Water Table Depth Before Rainfall, in.	Rise, in.	Water Table Depth After Rainfall, in.
3/1/60*	1.45			2.2	20.0+	0
		2	0.4			
3/3/60*	0.45			0.4	20.0+	0
		5	1.0			
3/8/60*	0.30			1.0	20.0+	0
		2	0.4			
3/10/60*	0.10			0.4	8.4	0
		4	0.8			
3/14/60*	1.15			0.8	20.0+	0
		1	0.2			
3/15/60*	0.15			0.2	12.6	0
		9	1.8			
3/24/60*	0.35			1.8	20.0+	0
		3	0.6			
3/27/60*	0.20			0.6	16.7	0
		9	5.3			
4/5/60*	0			5.3	--	--
		1	0.9			
4/6/60	0			6.2	--	--
		2	1.8			
4/8/60*	0.10			8.0	8.4	0
		6	5.4			
4/14/60*	0			5.4	--	--
		1	0.9			
4/15/60	0			6.3	--	--
		2	1.8			
4/17/60*	0.20			8.1	16.7	0
		3	2.7			
4/20/60*	0.85			2.7	20.0+	0
		5	4.5			
4/25/60*	0.60			4.5	20.0+	0
		5	4.5			
4/30/60*	0			4.5	--	--
		1	1.8			
5/1/60	0			6.3	--	--
		3	5.4			
5/4/60*	0.80			11.7	20.0+	0
		1	1.8			
5/5/60*	0.95			1.8	20.0+	0
		3	5.4			
5/8/60*	0			5.4	--	--
		1	1.8			
5/9/60	0			7.2	--	--
		11	19.8			
5/20/60	0.50			27.0	20.9	6.1
		9	16.2			
5/29/60	0			22.3	--	--
		1	1.8			
5/30/60*	0.70			24.1	29.3	0
		2	5.8			
6/1/60*	0.10			5.8	8.4	0
		1	4.0			
6/2/60*	0			4.0	--	--
		1	4.0			
6/3/60	0			8.0	--	--
		11	44.0			
6/14/60	0			>48		

* Period when water table was above a depth of 6 in.

Table 23

Average Deviations Between Predicted and Measured Water Tables for Moisture-Strength Sites

Sites		Deviation, in. Water Table Above Depth of 48 in. or Relatively Impermeable Layer	Deviation, in. Water Table Above Depth of 6 in.
Upland position			
Upland flat			
MS7		2.3	1.6
MS10		4.8	1.6
MS11		4.6	2.9
MS12		3.8	1.8
	Avg	3.9	2.0
Low-lying positions			
Bottom of slope			
MS1		4.0	1.4
MS6		4.4	1.7
	Avg	4.2	1.6
Major bottomland			
MS2		3.3	0.9
MS3		3.4	1.2
MS4		2.5	1.4
	Avg	3.1	1.2
Minor bottomland			
MS8		7.8	6.2
MS9		8.8	9.1
	Avg	8.3	7.6
Avg all sites		4.5	2.7

Table 24

Range and Deviation of Strength Data for Moisture-Strength Sites

	Range of Data			Average Deviation from Curve		
Site No.	Cone Index	Rating Cone Index	Remolding Index	Cone Index	Rating Cone Index	Remolding Index
MS1	67-284	23-224	0.19-0.79	12	2	0.03
MS2	25-195	9-107	0.23-0.65	21	16	0.11
MS3	38-109	18-52	0.16-0.53	4	6	0.10
MS4	72-298	43-91	0.58-0.76	4	8	0.06
MS5	64-198	31-188	0.44-0.96	8	6	0.02
MS6	137-298	21-132	0.14-0.61	12	6	0.02
MS7	115-300	37-103	0.17-0.44	9	36	0.07
MS8	61-260	10-300	0.14-1.32	14	5	0.04
MS9	42-236	17-158	0.40-0.78	7	4	0.05
MS10	81-294	11-221	0.13-0.76	15	19	0.07
MS11	53-245	25-151	0.24-0.63	13	12	0.06
MS12	64-250	19-200	0.26-0.81	12	10	0.06
			Avg	11	11	0.06

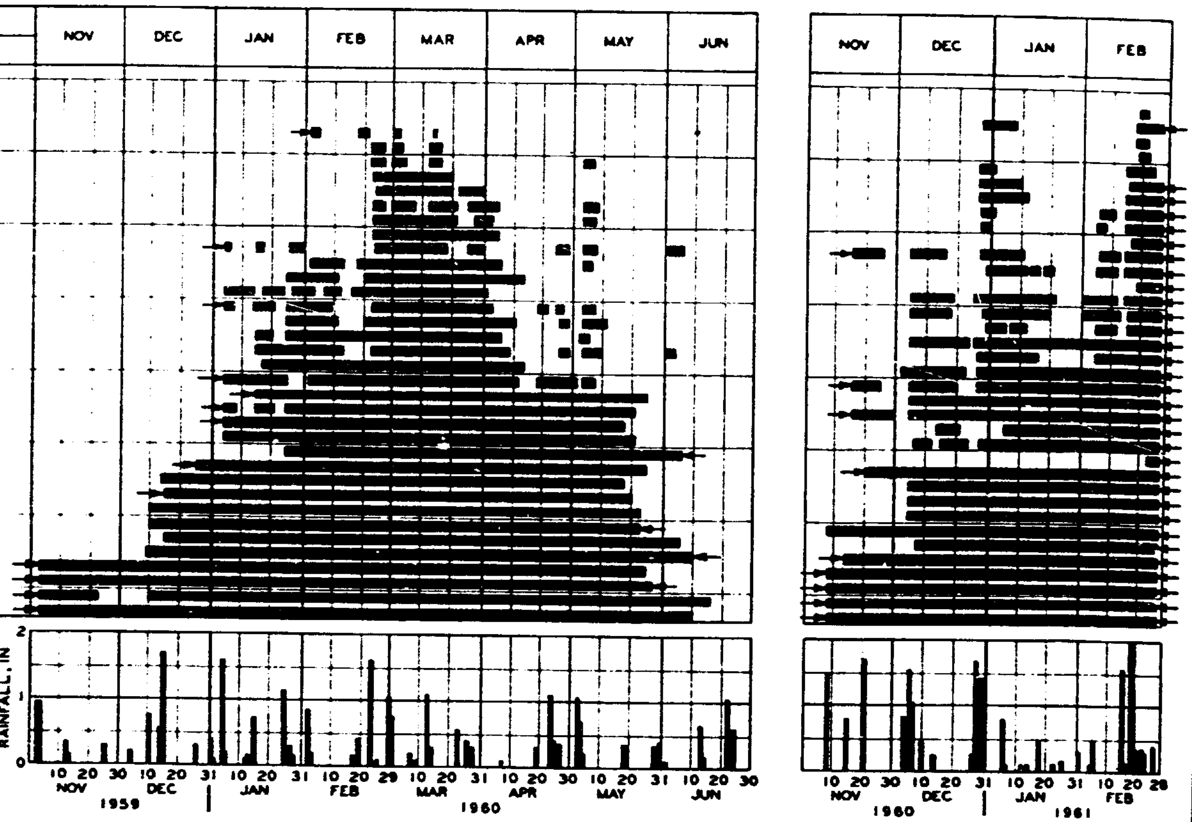
Table 25

Deviations Between Measured and Predicted Moisture Content and Rating Cone Index for Site MS2

			Moisture Content, 6- to 12-in. Layer, in. of Water/6 in. of Soil							Rating Cone Index, 6- to 12-in. Layer						
			Predicted				Deviation Between Measured and Predicted			Predicted‡‡				Deviation Between Measured and Predicted		
Season	Date	Predicted Water Table Depth,* in.	WES Method**	Mod I Method†	Mod II Method††	Meas-ured‡	WES Method	Mod I Method	Mod II Method	WES Method	Mod I Method	Mod II Method	Meas-ured§	WES Method	Mod I Method	Mod II Method
Winter	12/19/59	<6	§§	2.93	2.93	2.64	§§	§§	§§	8	8	8	14	6	6	6
	1/13/60	<6	2.75	2.93	2.93	2.46	0.29	0.47	0.47	8	8	8	9	1	1	1
	2/25/60	<6	2.86	2.93	2.93	2.77	0.09	0.16	0.16							
	3/8/60	<6	2.86	2.93	2.93	2.83	0.03	0.10	0.10							
						Avg	0.14	0.24	0.24					4	4	4
Spring	3/25/60	<6	2.70	2.93	2.93	2.99	0.29	0.06	0.06							
	3/30/60	<6	2.61	2.93	2.93	3.10	0.49	0.17	0.17	10	8	8		1	1	1
	3/31/60	<6	2.58	2.93	2.93	2.90	0.32	0.03	0.03							
	4/4/60	<6	2.46	2.93	2.93	2.85	0.39	0.08	0.08							
	4/25/60	<6	2.23	2.93	2.93	2.96	0.73	0.03	0.03							
	5/3/60	>6	2.18	2.84	2.84	2.95	0.77	0.11	0.11							
						Avg	0.50	0.08	0.08					1	1	1
Summer	5/10/60	>6	2.55	2.88	2.88	2.80	0.25	0.08	0.08							
	5/17/60	>6	1.94	2.14	2.65	2.56	0.62	0.42	0.09	90	50	9	11	79	39	2
	5/23/60	>6	1.68	1.83	2.60	2.50	0.82	0.67	0.10	120	100	10	9	111	91	1
	6/6/60	>6	1.12	1.17	2.41	2.09	0.97	0.92	0.32	300	300	19	39	261	261	20
	6/10/60	>6	0.95	1.00	2.31	1.80	0.85	0.80	0.51	300	300	25	79	221	221	54
	6/14/60	>6	0.82	0.86	1.97	2.11	1.29	1.25	0.14	300	300	82	107	193	193	25
	6/16/60	>6	0.93	0.97	2.03	1.70	0.77	0.73	0.33							
						Avg	0.80	0.70	0.22					173	161	20

* From table 22.
** Computed in accordance with procedures explained in reference 2e.
† Explained in paragraph 96.
†† Explained in paragraph 97.
‡ Converted to inches from percent dry weight moisture content data for site MS2 in table 7.
‡‡ Derived from moisture content-RCI curve for site MS2 in plate 17.
§ From table 7.
§§ Starting date, no deviations computed.

SITE NO.	DURATION OF WATER TABLE IN WELL, 4 NOV 1959 – 16 JUNE 1960	
	DAYS	% OF TIME
MS 5	0	0
W 6	0	0
W 2	0	0
W 7	9	4
W 3	12	5
W 15	17	8
W 4	27	12
W 8	33	15
W 16	36	16
W 18	38	17
W 11	42	19
W 20	55+	24+
W 13	[illegible]	28
W 22	71	31
MS 7	72	32
W 21	75+	33+
W 23	79	35
W 12	81	36
W 19	86	38
W 17	102	45
W 24	112+	50+
W 1	131	58+
W 14	134+	59+
W 25	134	59+
MS 8	139	61
W 9	143+	63+
W 5	150+	66+
W 10	156	69
MS 12	157+	69+
MS 1	165	73
MS 6	165+	73+
MS 9	174	77
MS 4	184+	81+
MS 11	205+	91+
MS 10	207+	92+
MS 3	209+	92+
MS 2	220+	97+



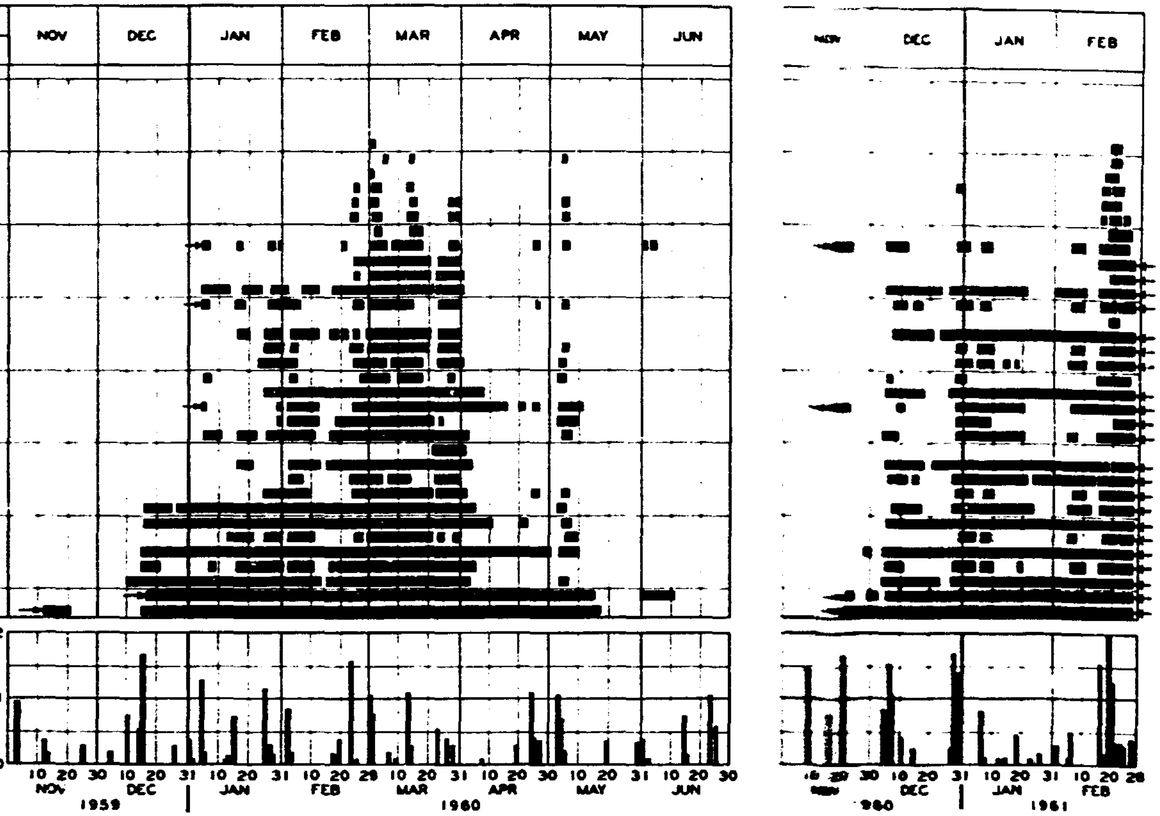
NOTE ARROW INDICATES THAT A WATER TABLE WAS PRESENT PRIOR TO FIRST VISIT OR AT TIME OF LAST VISIT IN SEASON OF RECORD.

RAINFALL RECORD IS THAT OF CROSSETT TML AND APPLICABLE TO SITES MS10, MS11, AND MS12. RAINFALL RECORDS FOR OTHER SITES ARE SIMILAR (SEE PLATES 6 AND 8 (SITE MS9) FOR RECORDS OF YALE AND BERLIN DISTRICT HDQRS. RESPECTIVELY).

DURATION OF WATER TABLES IN WELLS

PLATE I

SITE NO.	DURATION OF WATER TABLE IN SURFACE FOOT, 4 NOV 1959 – 16 JUNE 1960: DAYS	% OF TIME
MS 5	0	0
W 6	0	0
W 2	0	0
W 7	0	0
W 3	1	0
W 15	3	1
W 4	1	0
W 8	7	3
W 16	10	4
W 18	13	6
W 11	6	3
W 20	32+	14+
W 13	33	15
W 22	32	14
MS 7	68	30
W 21	50	22
W 23	0	0
W 12	54	24
W 19	42	19
W 17	39	17
W 24	30	13
W 1	74	33
W 14	77+	34+
W 25	51	23
MS 8	77	34
W 9	6	3
W 5	64	28
W 10	30	13
MS12	57	25
MS 1	111	49
MS 6	123	54
MS 9	53	23
MS 4	145	64
MS11	78	34
MS10	116	51
MS 3	161+	71+
MS 2	162+	72+

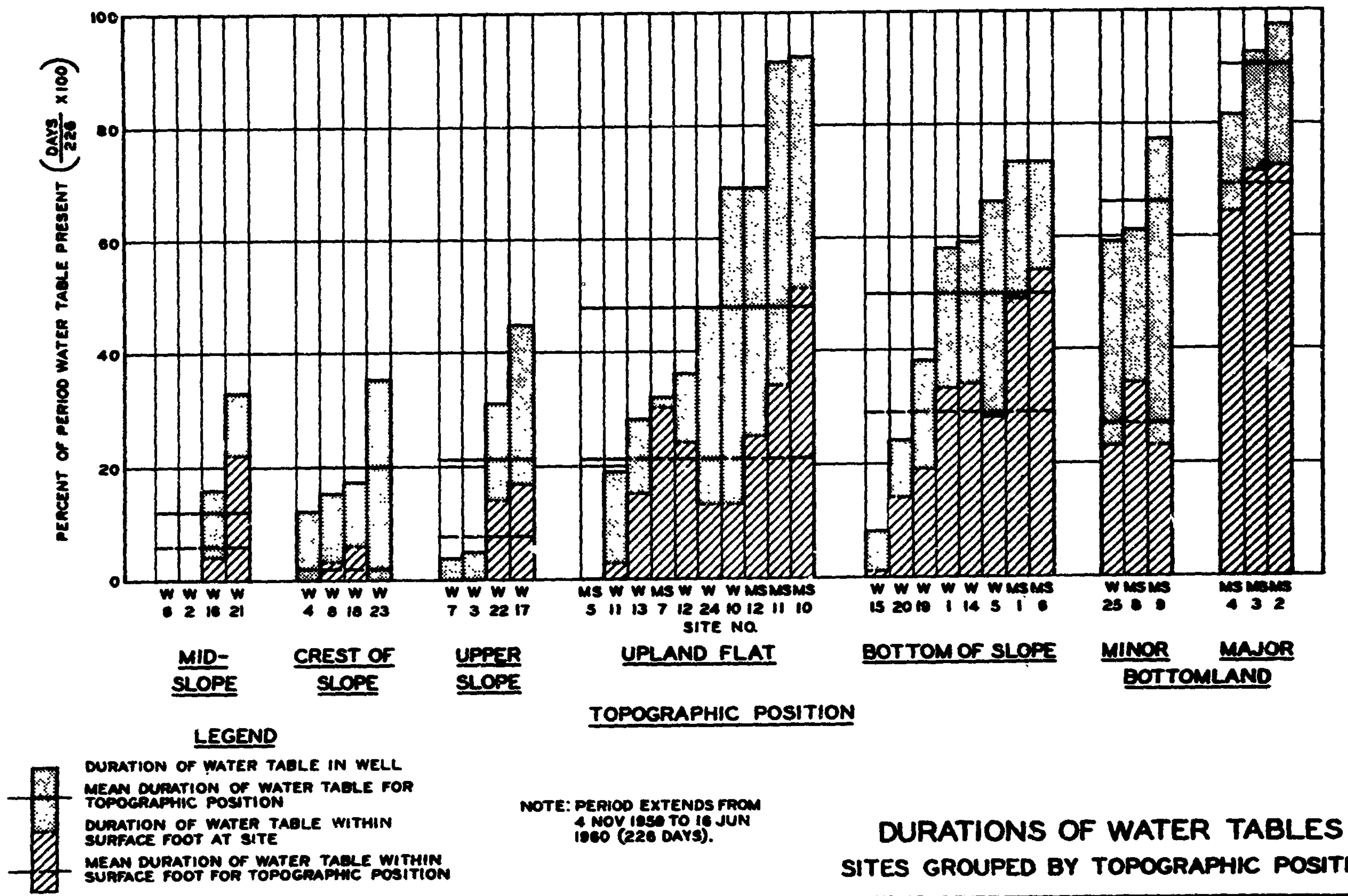


NOTE: ARROW INDICATES THAT A WATER TABLE WAS PRESENT PRIOR TO FIRST VISIT OR AT TIME OF LAST VISIT IN SEASON OF RECORD.

RAINFALL RECORD IS THAT OF CROSSETT TML AND APPLICABLE TO SITES MS10, MS11, AND MS12. RAINFALL RECORDS FOR OTHER SITES ARE SIMILAR (SEE PLATES 6 AND 8 (SITE MS9) FOR RECORDS OF YALE AND BERLIN DISTRICT HDQRS, RESPECTIVELY).

DURATION OF WATER TABLES WITHIN SURFACE FOOT

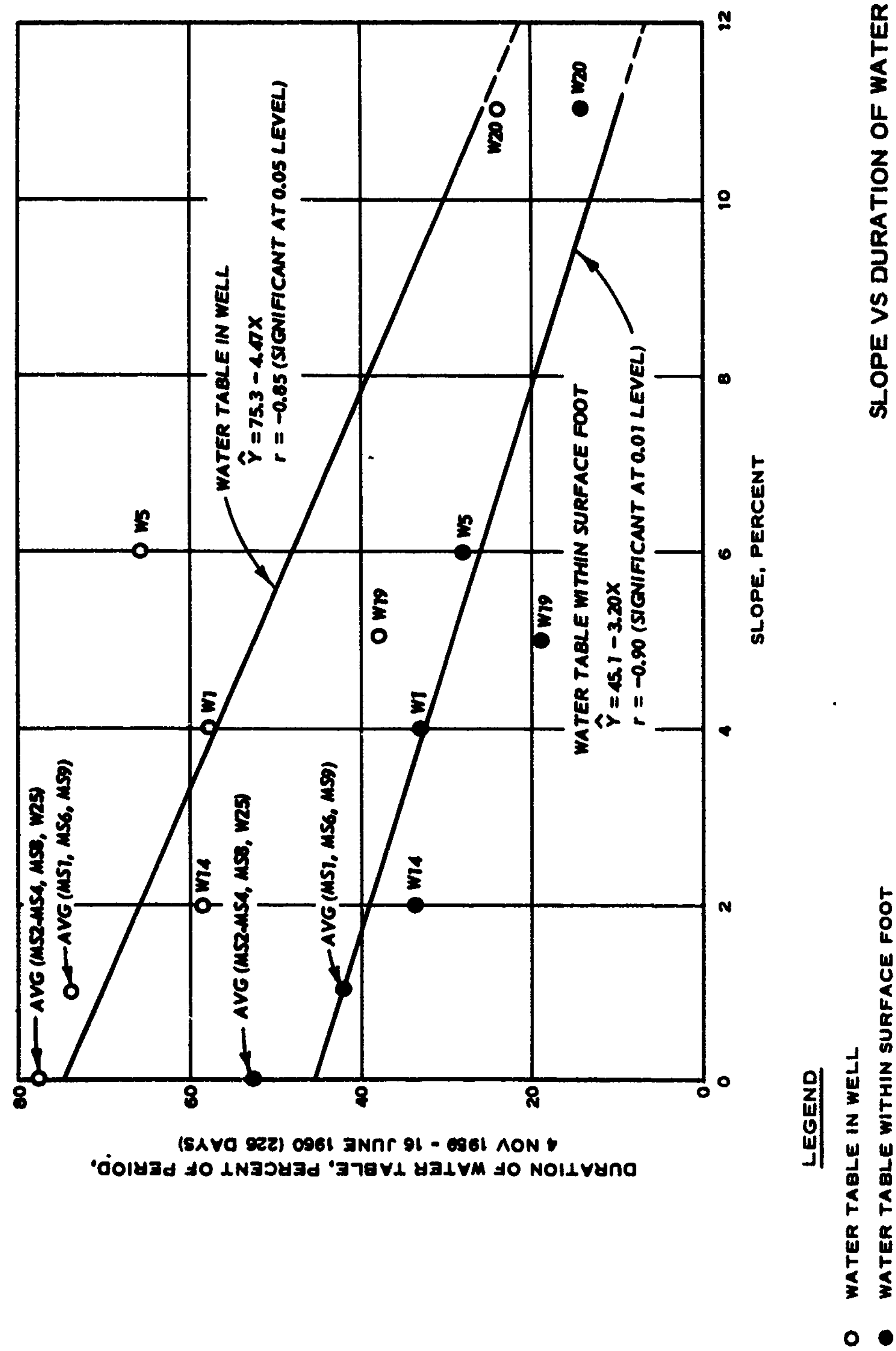
PLATE 2



DURATIONS OF WATER TABLES

SITES GROUPED BY TOPOGRAPHIC POSITION

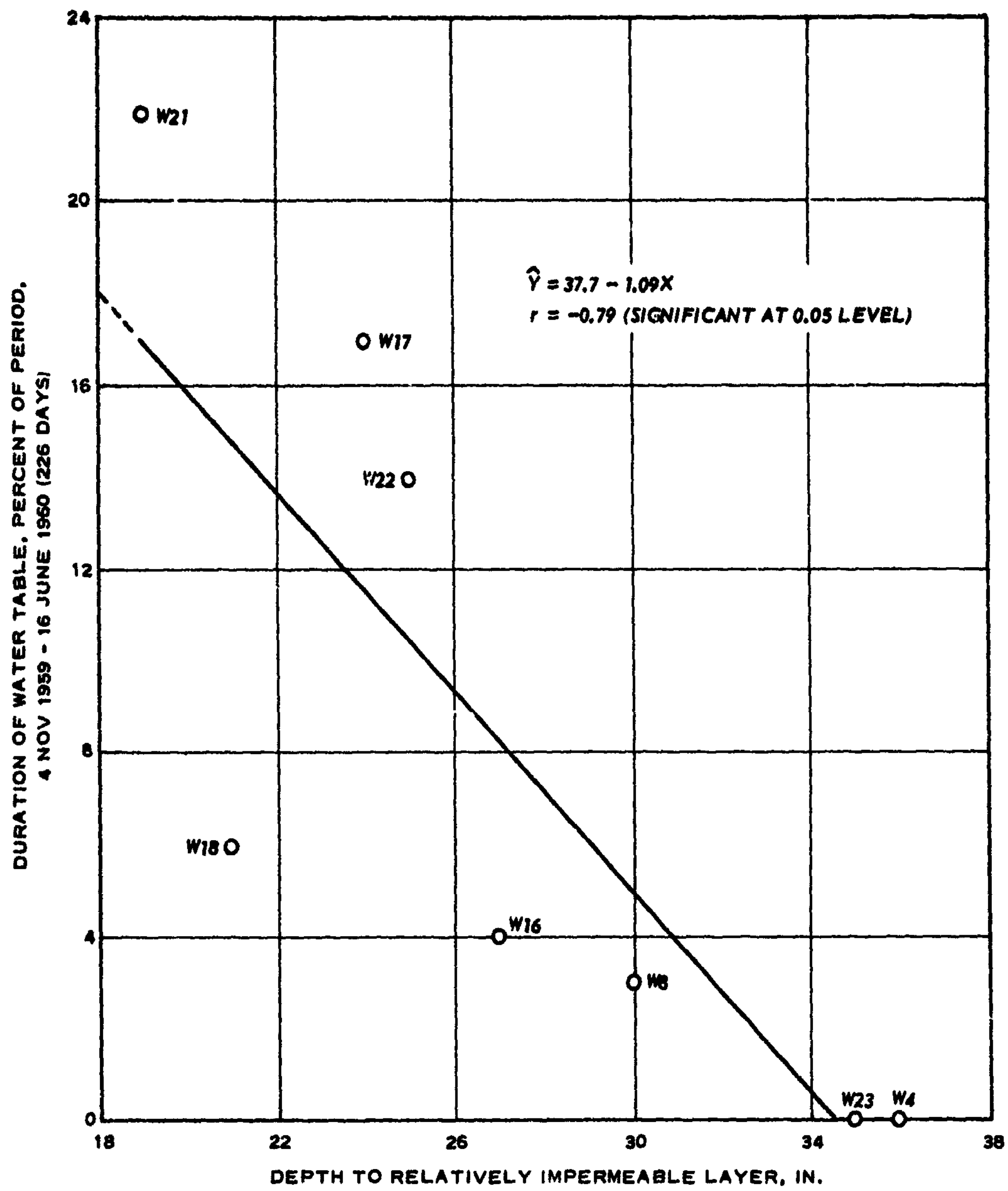
PLATE 3



SLOPE VS DURATION OF WATER TABLE

SITES ON LOW-LYING POSITIONS

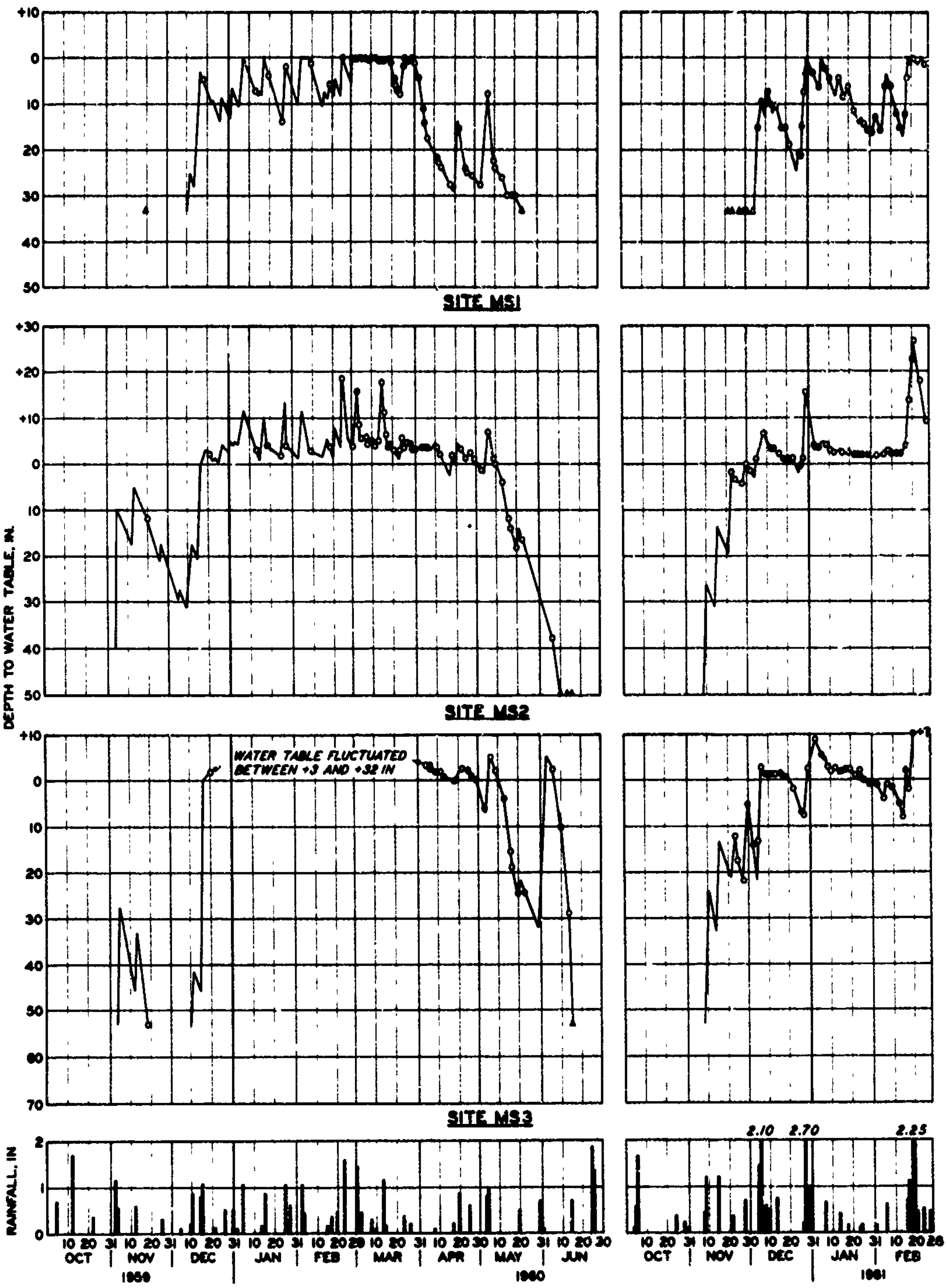
PLATE 4



DEPTH TO RELATIVELY IMPERMEABLE LAYER VS DURATION OF WATER TABLE WITHIN SURFACE FOOT

SITES ON SLOPE POSITIONS

PLATE 5



LEGEND

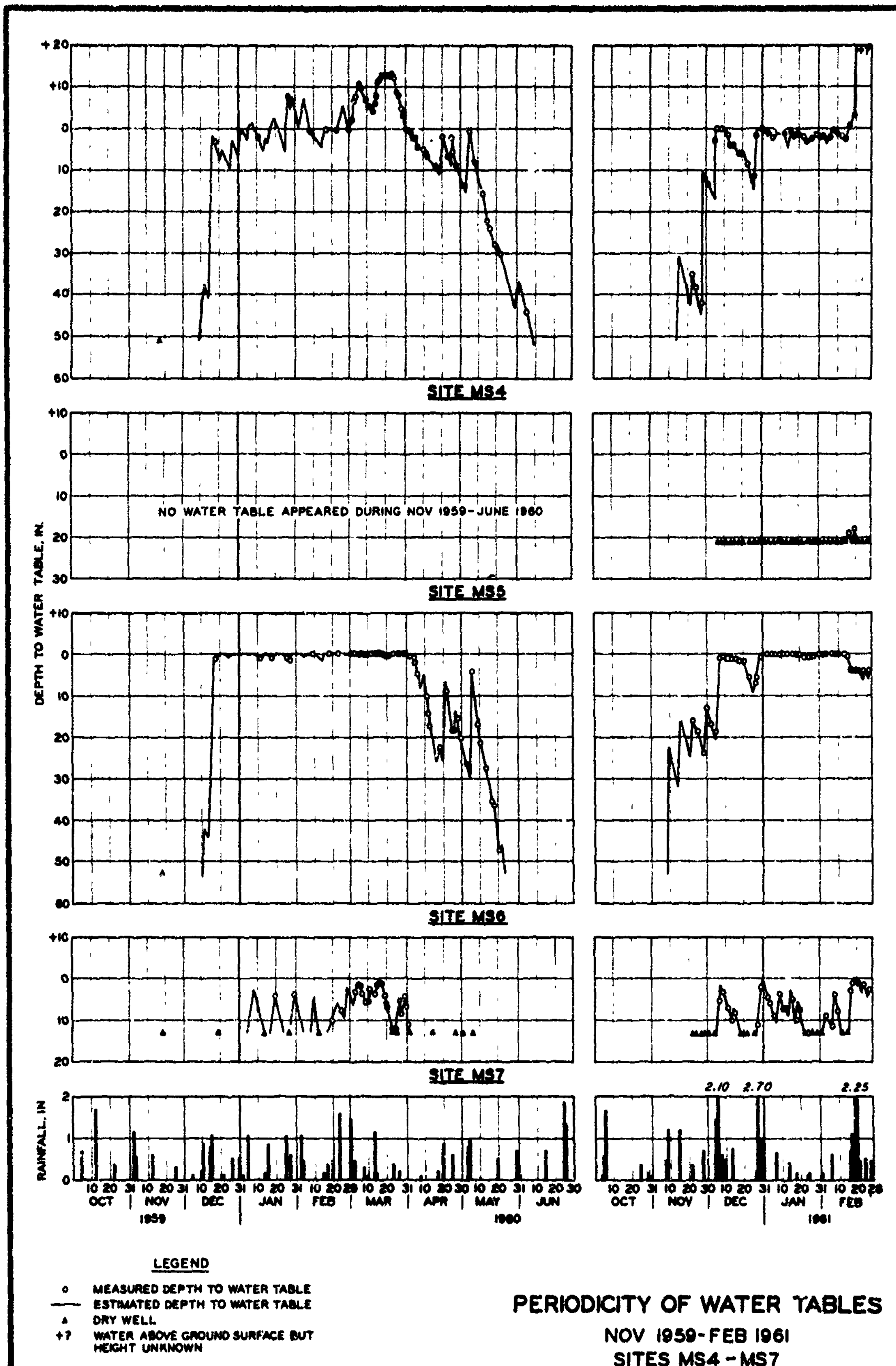
- o MEASURED DEPTH TO WATER TABLE
- — ESTIMATED DEPTH TO WATER TABLE
- ▲ DRY WELL
- +? WATER ABOVE GROUND SURFACE BUT HEIGHT UNKNOWN

PERIODICITY OF WATER TABLES

NOV 1959-FEB 1961

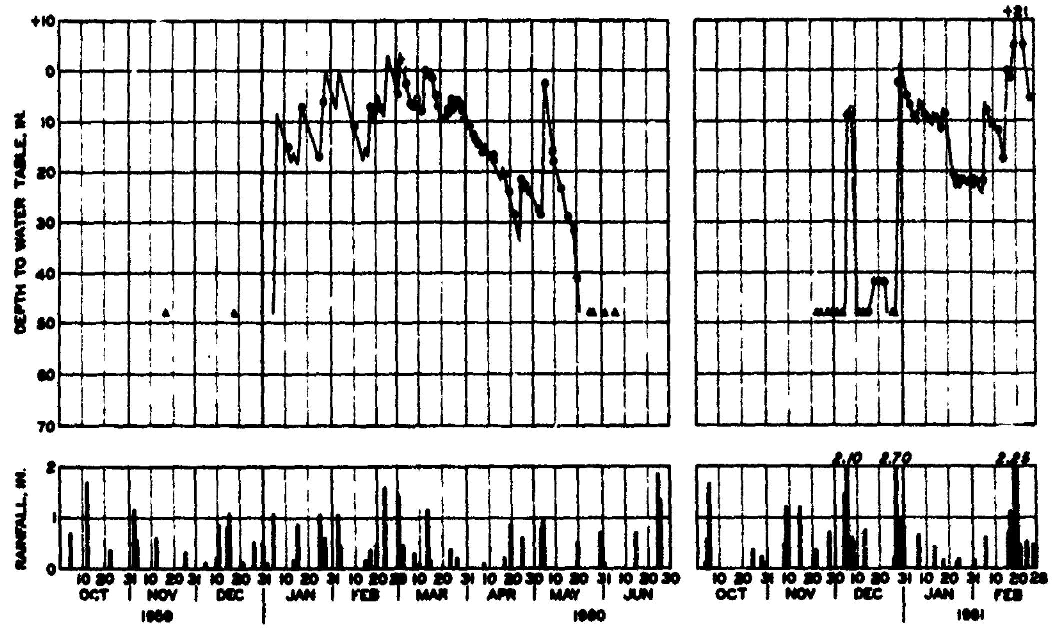
SITES MS1-MS3

PLATE 6

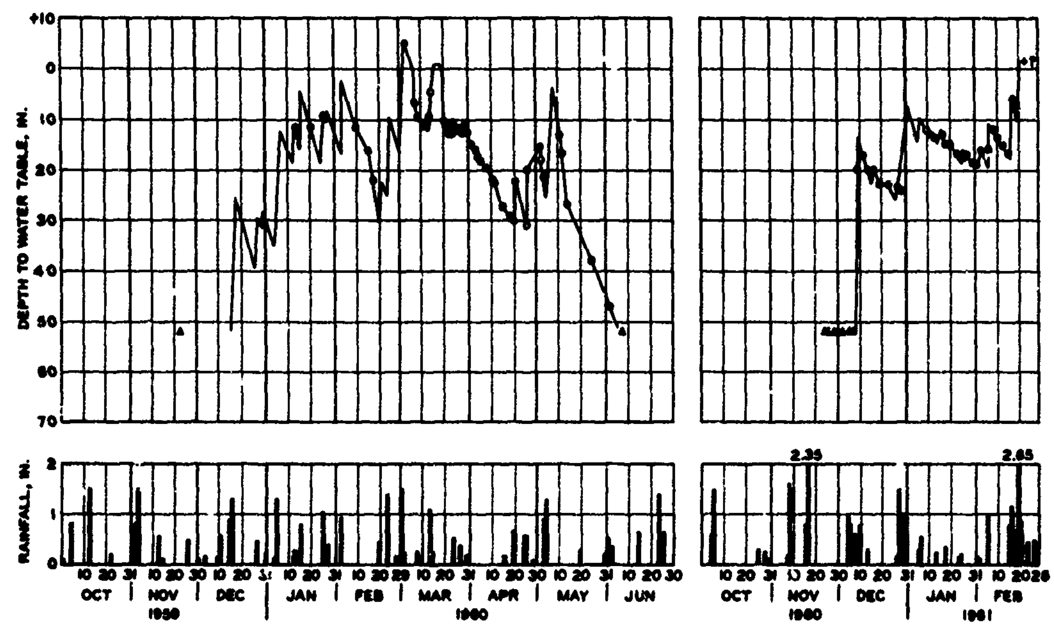


PERIODICITY OF WATER TABLES
NOV 1959-FEB 1961
SITES MS4-MS7

PLATE 7



SITE MS8



SITE MS9

LEGEND

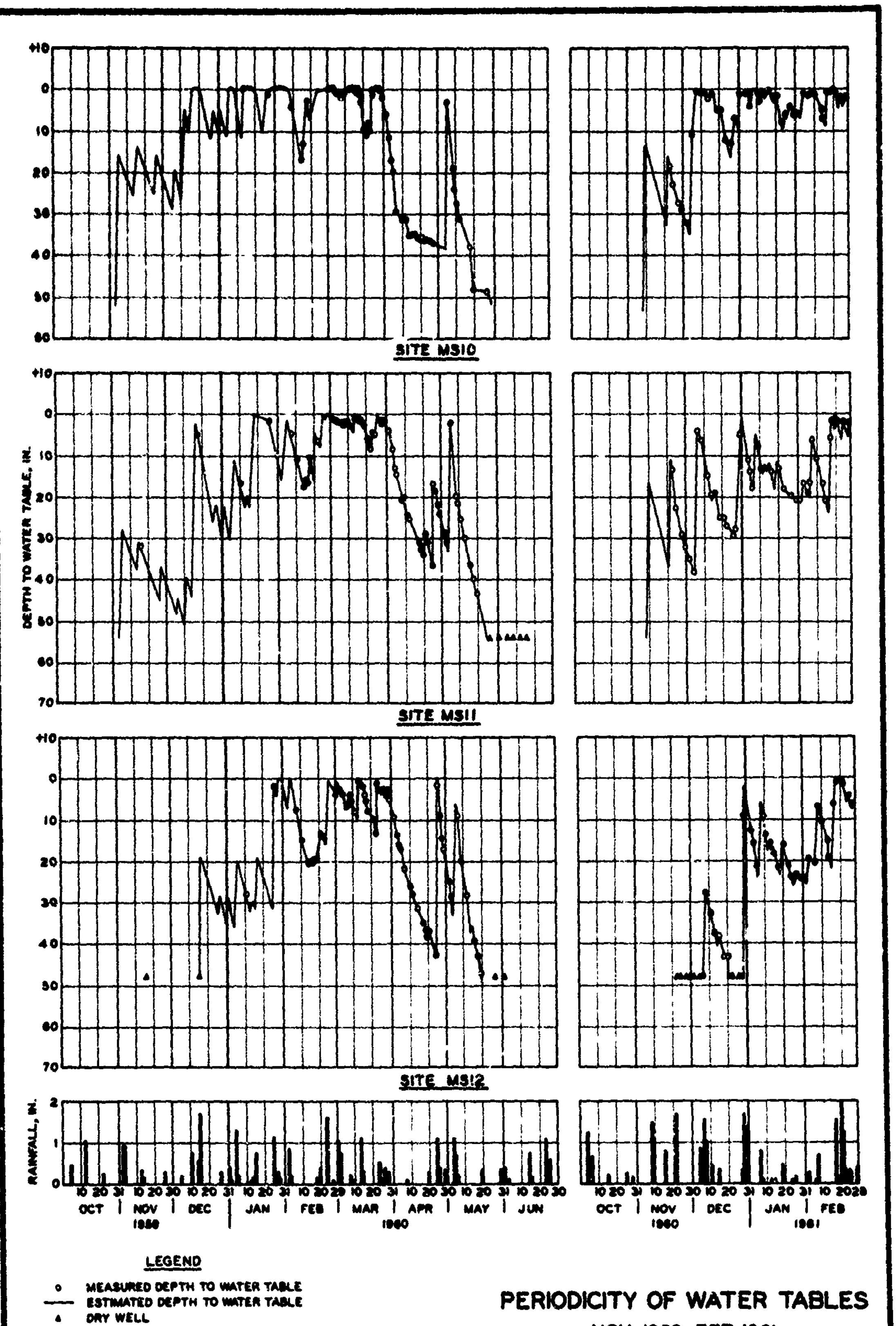
- o MEASURED DEPTH TO WATER TABLE
- — ESTIMATED DEPTH TO WATER TABLE
- ▲ DRY WELL
- +3 WATER 3 IN. ABOVE GROUND SURFACE
- +? WATER ABOVE GROUND SURFACE BUT HEIGHT UNKNOWN

PERIODICITY OF WATER TABLES

NOV 1959-FEB 1961

SITES MS8, MS9

PLATE 8

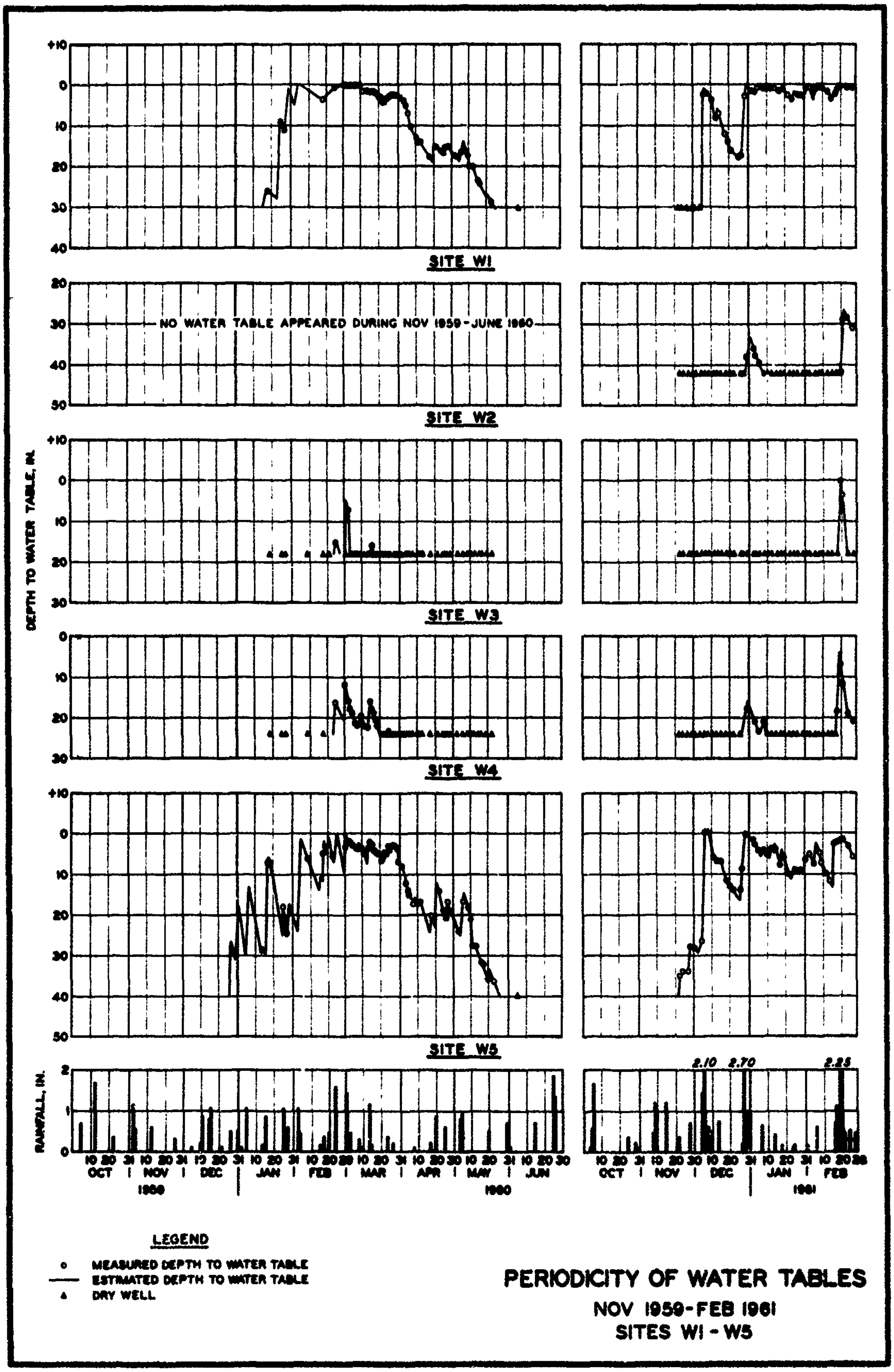


PERIODICITY OF WATER TABLES

NOV 1959-FEB 1961

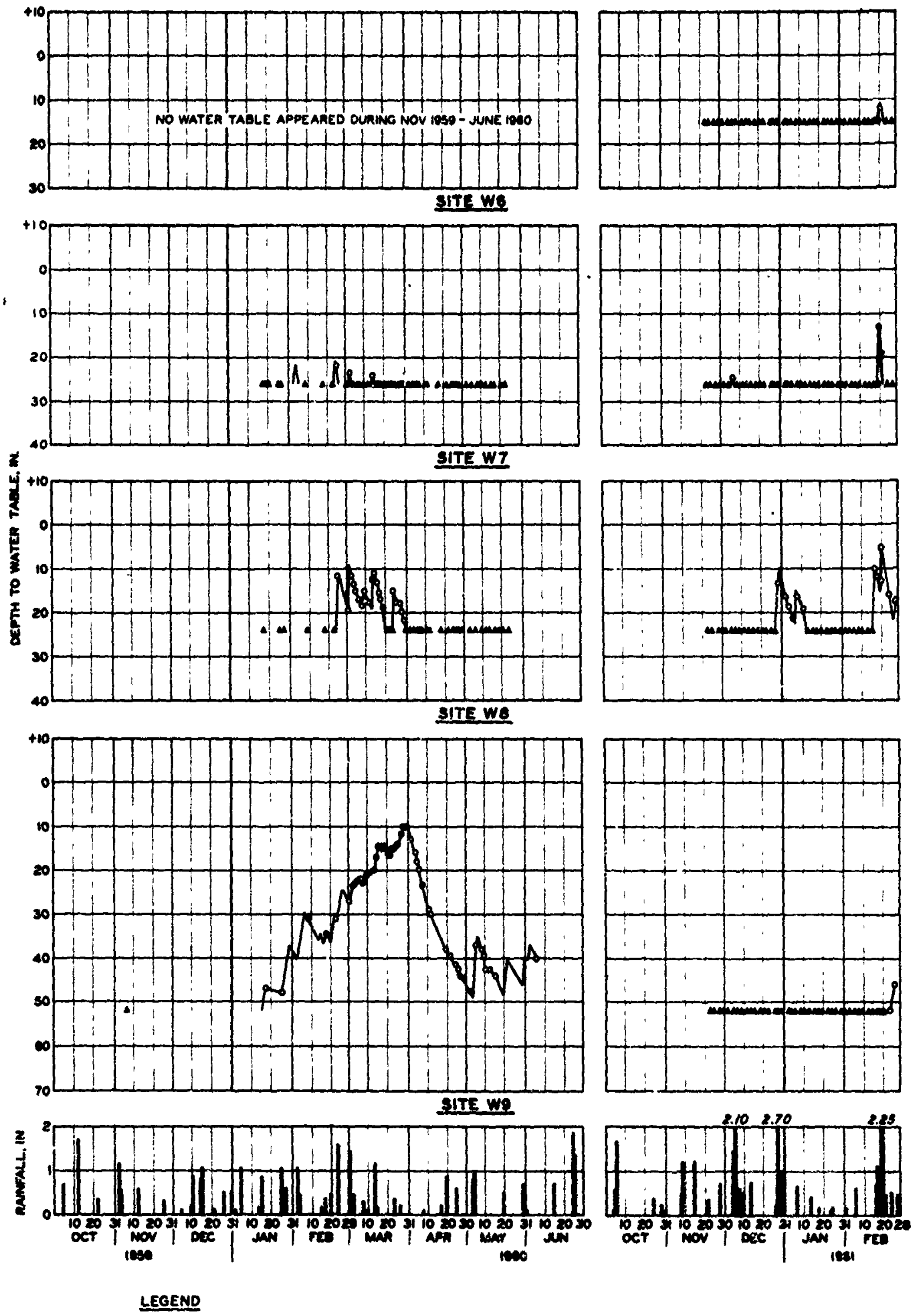
SITES MS10-MS12

PLATE 9



SITE W1
NO WATER TABLE APPEARED DURING NOV 1959 - JUNE 1960
SITE W2
SITE W3
SITE W4
SITE W5
DEPTH TO WATER TABLE, IN.
RAINFALL, IN.
2.10
2.70
2.25
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
1959
1960
1961
LEGEND
MEASURED DEPTH TO WATER TABLE
ESTIMATED DEPTH TO WATER TABLE
DRY WELL
PERIODICITY OF WATER TABLES
NOV 1959-FEB 1961
SITES W1 - W5

PLATE 10

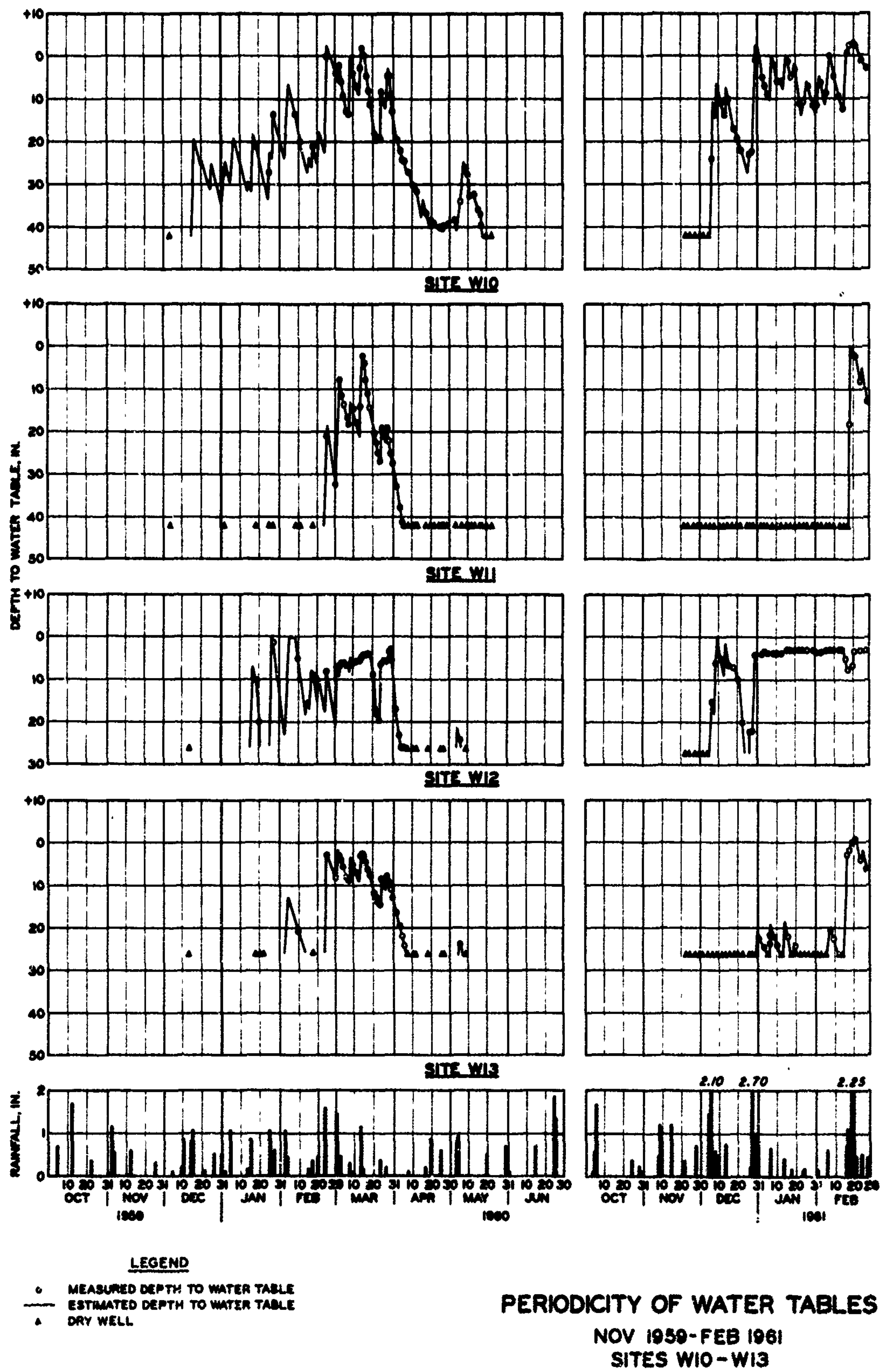


PERIODICITY OF WATER TABLES

NOV 1959-FEB 1961

SITES W6-W9

PLATE II

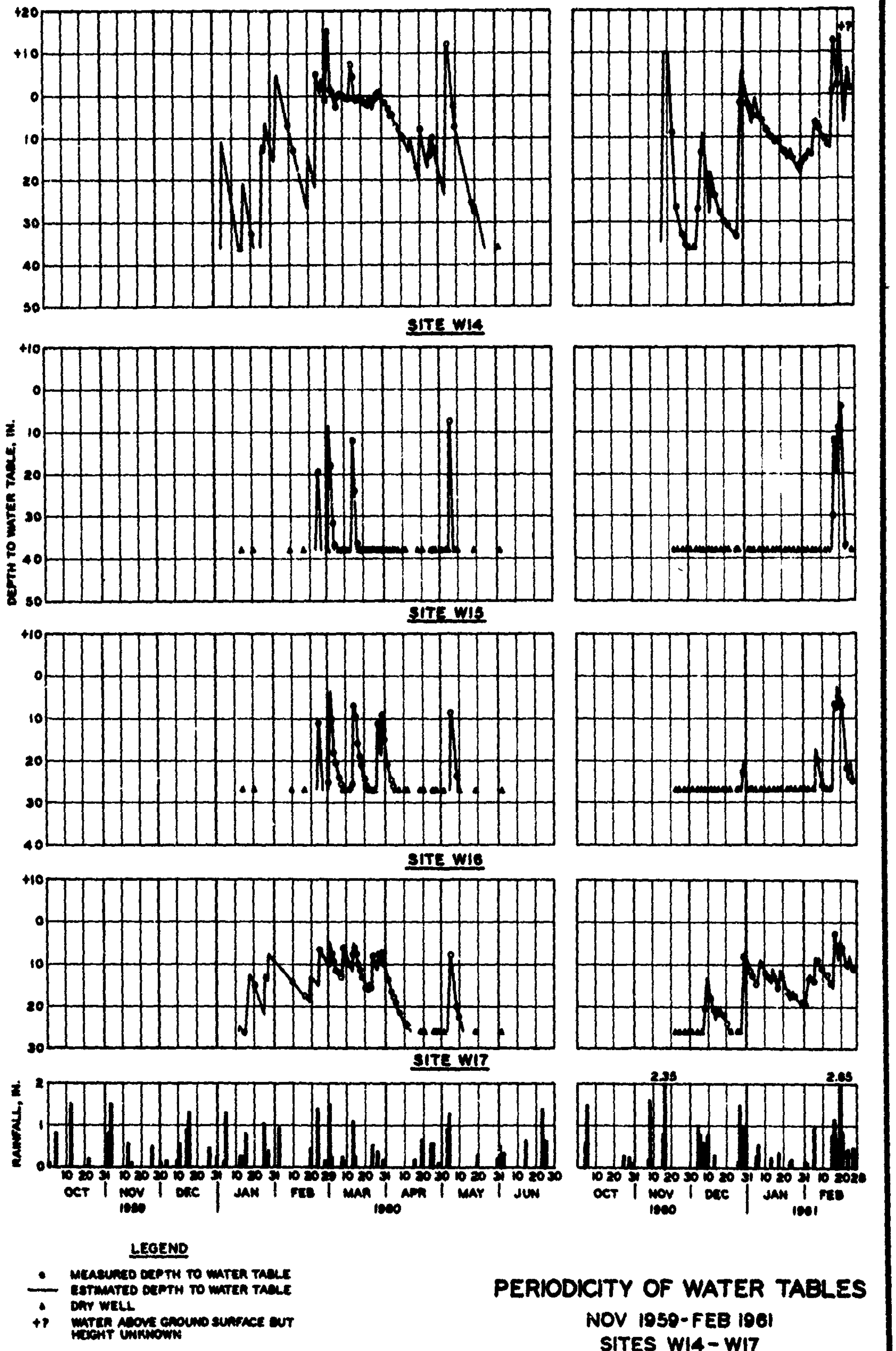


PERIODICITY OF WATER TABLES

NOV 1959-FEB 1961

SITES W10-W13

PLATE 12

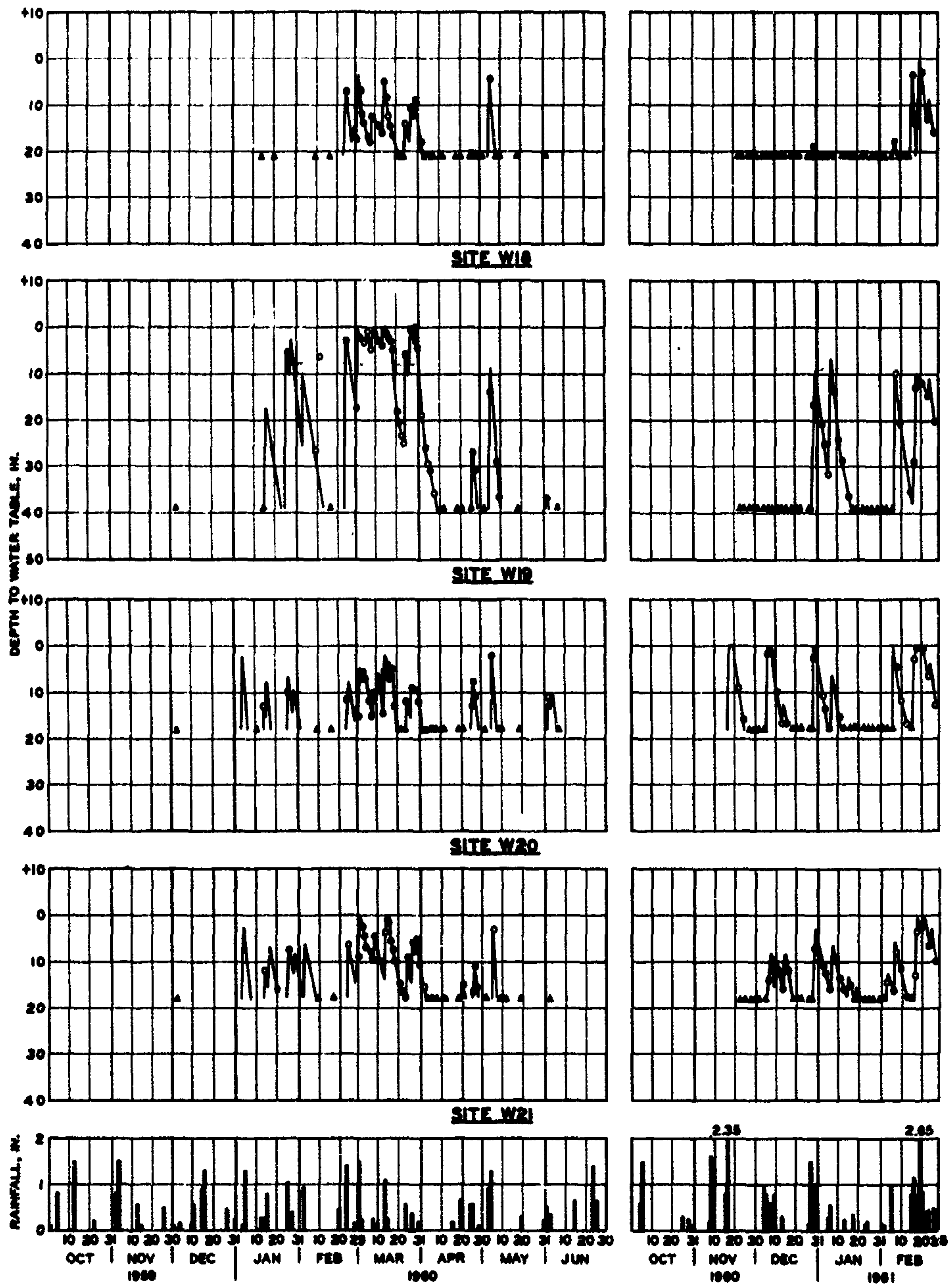


PERIODICITY OF WATER TABLES

NOV 1959-FEB 1961

SITES W14-W17

PLATE 13



LEGEND

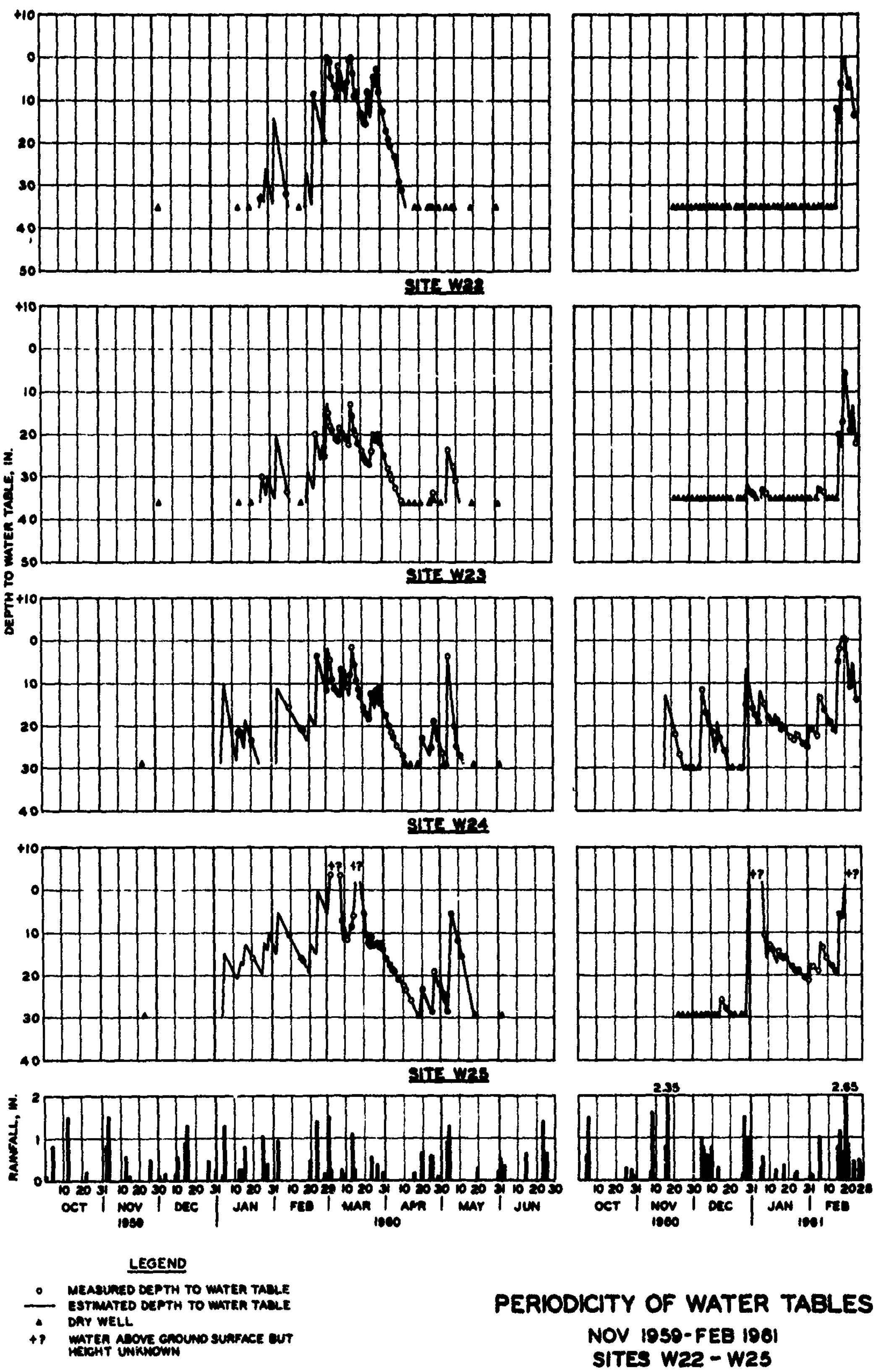
- • MEASURED DEPTH TO WATER TABLE
- — ESTIMATED DEPTH TO WATER TABLE
- ▲ DRY WELL

PERIODICITY OF WATER TABLES

NOV 1959-FEB 1961

SITES W18-W21

PLATE 14



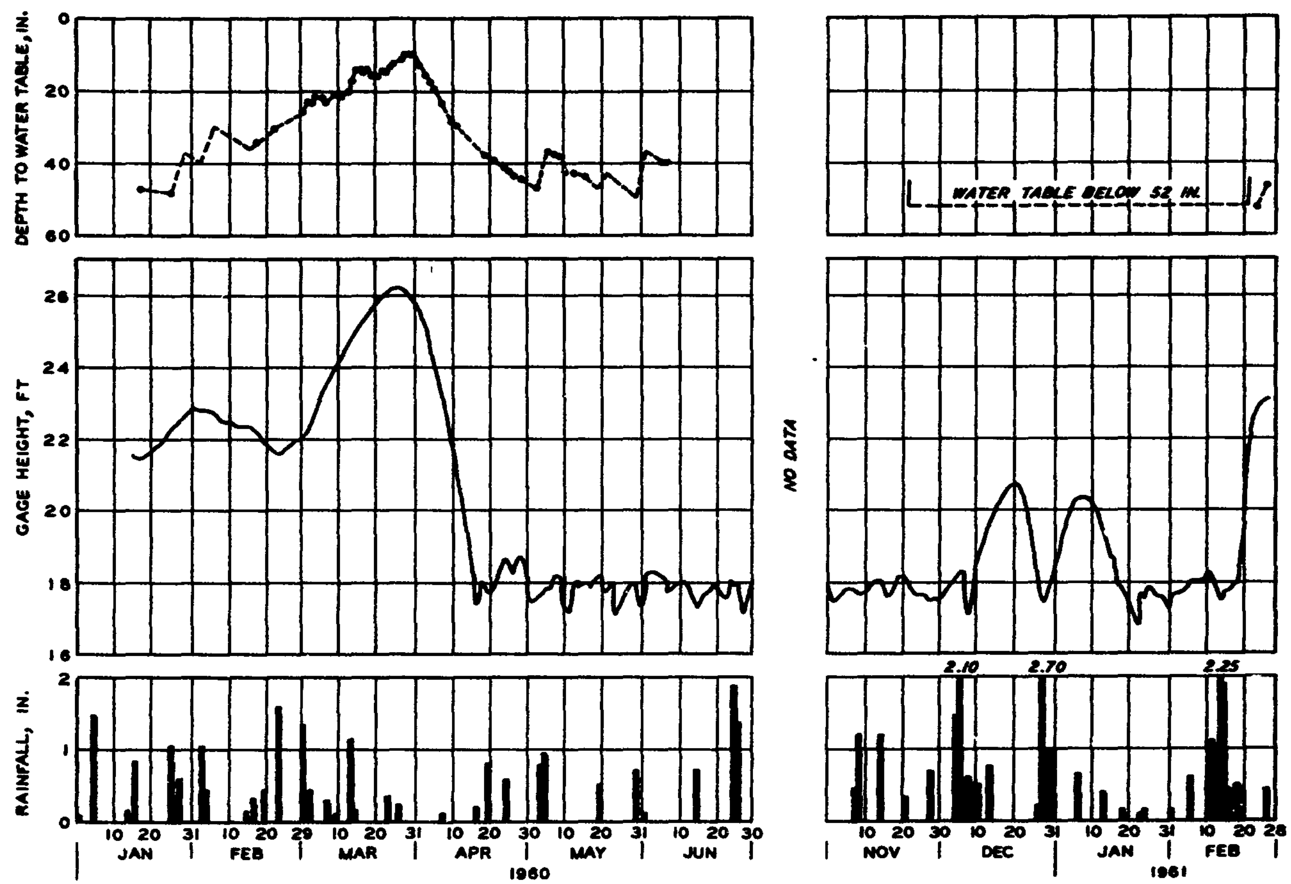
PERIODICITY OF WATER TABLES

NOV 1959-FEB 1961

SITES W22 - W25

PLATE 15

PLATE 16



NOTE: SITE W9 WAS LOCATED 1/2 MILE FROM RIVER IN FLOODPLAIN OF OUACHITA RIVER, 8 MILES DUE WEST OF CROSSETT, ARK. GAGE HEIGHTS OF THE RIVER WERE RECORDED AT LOCK AND DAM 6, UPPER POOL, FELSENTHAL, ARK., 8 MILES SOUTH OF SITE W9.

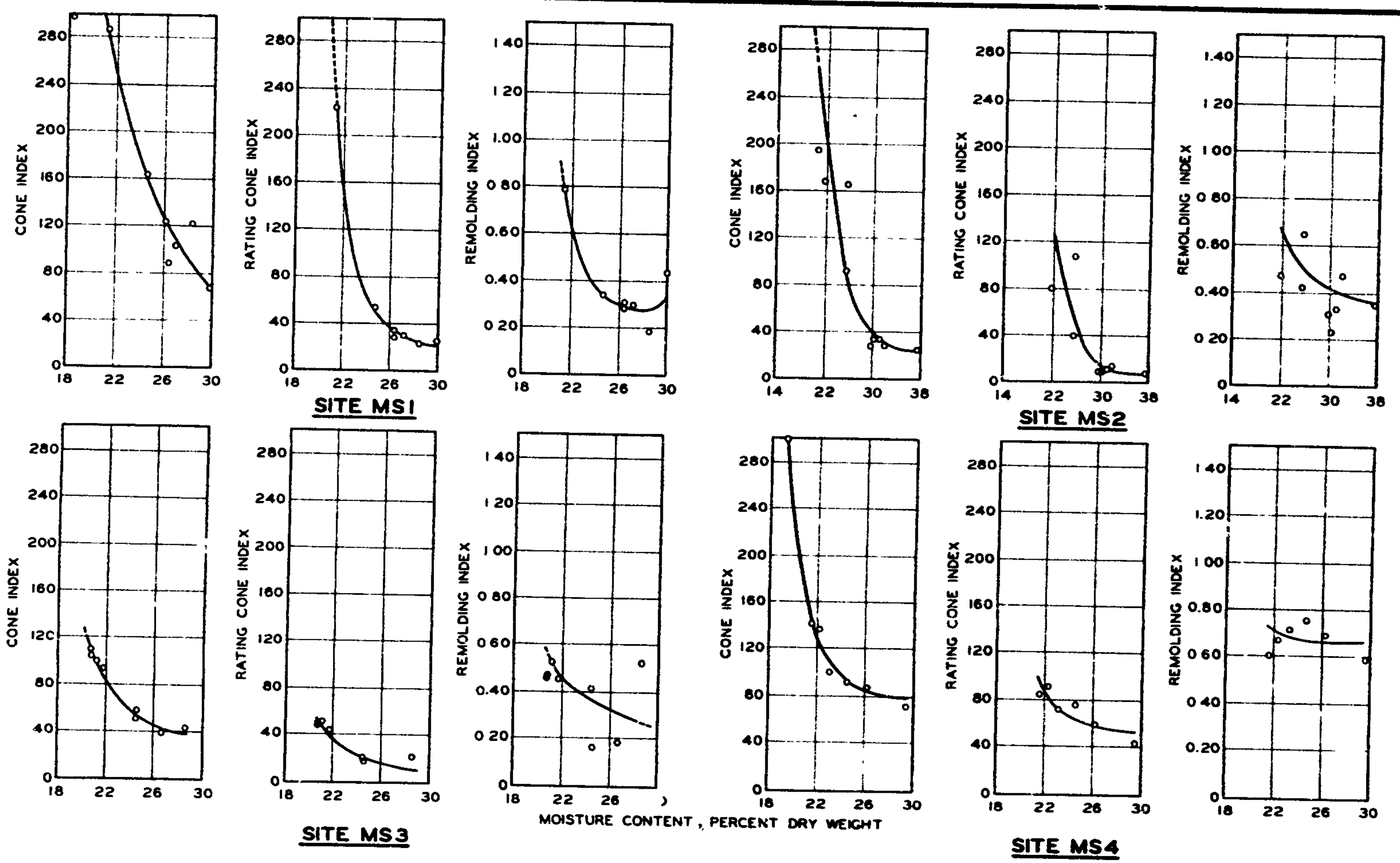
RAINFALL RECORD FROM YALE DISTRICT HQ, LOCATED 7 MILES FROM SITE W9.

LEGEND

- • MEASURED DEPTH TO WATER TABLE
- ---- ESTIMATED DEPTH TO WATER TABLE
- —— RECORDED GAGE HEIGHT OF OUACHITA RIVER

PERIODICITY OF WATER TABLE AT SITE W9 VERSUS STAGES OF OUACHITA RIVER

JAN 1960 – FEB 1961

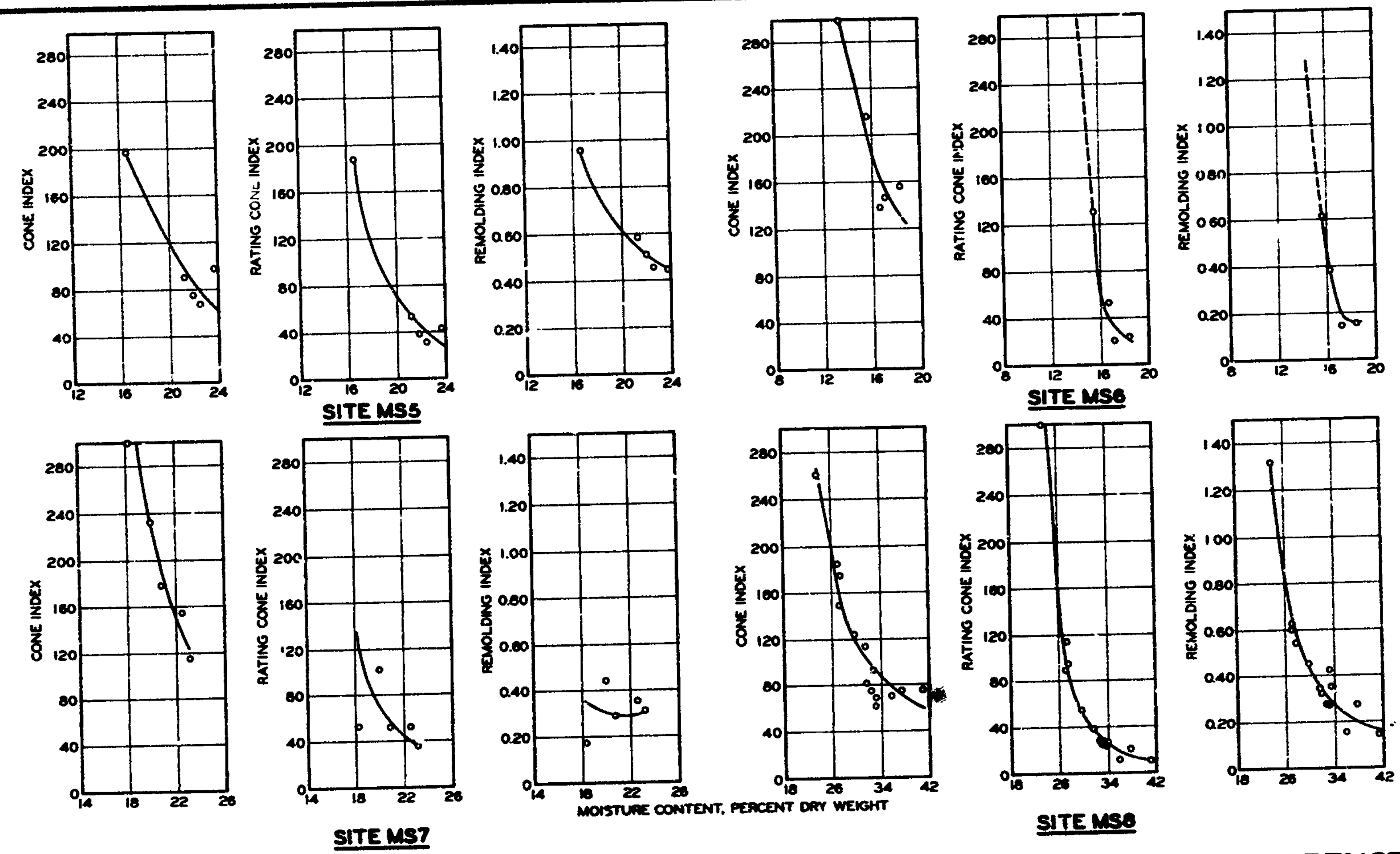


SOIL MOISTURE-STRENGTH RELATIONS

6- TO 12-IN. LAYER

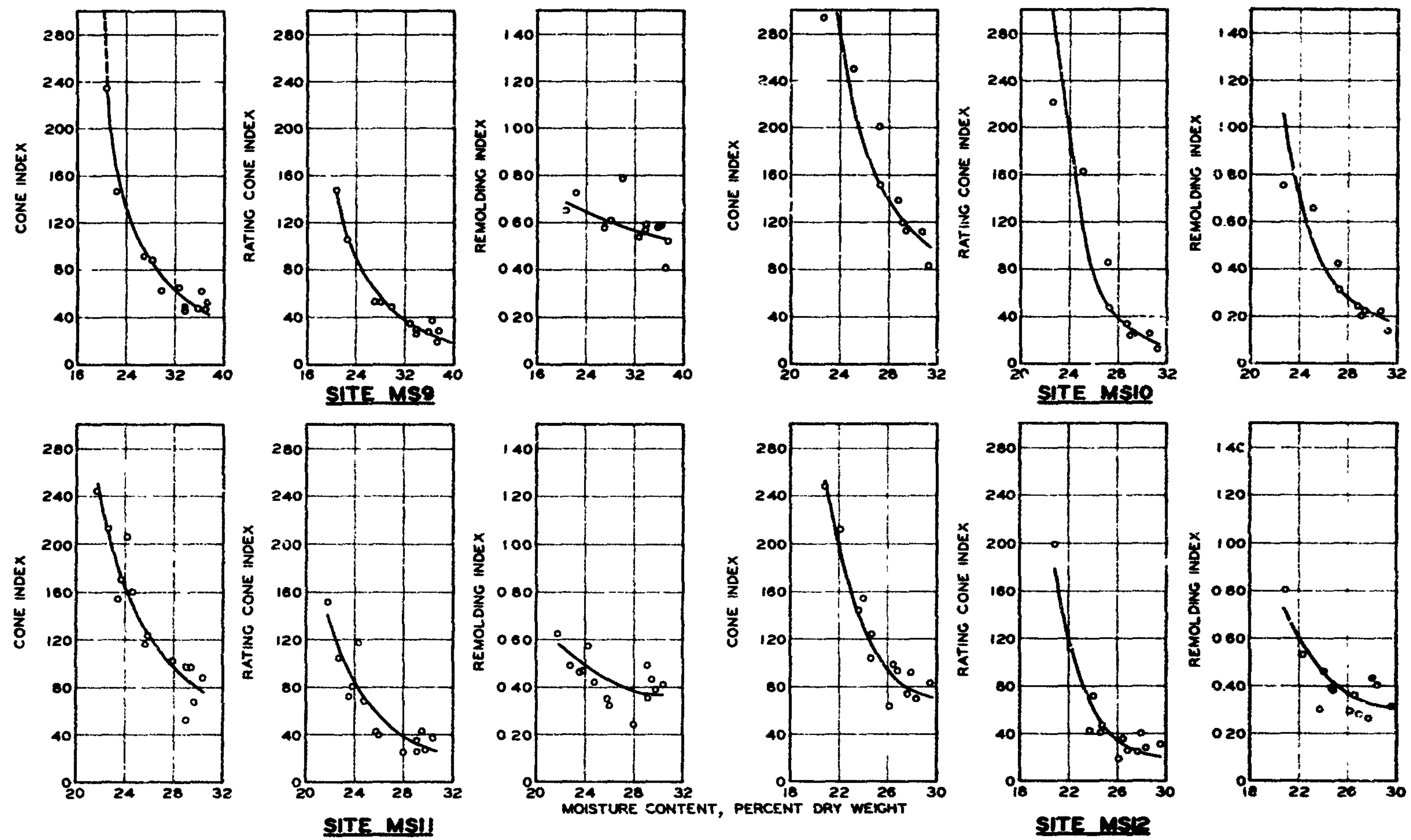
SITES MS1-MS4

PLATE 17



SOIL MOISTURE-STRENGTH RELATIONS
6- TO 12-IN. LAYER
SITES MS5-MS8

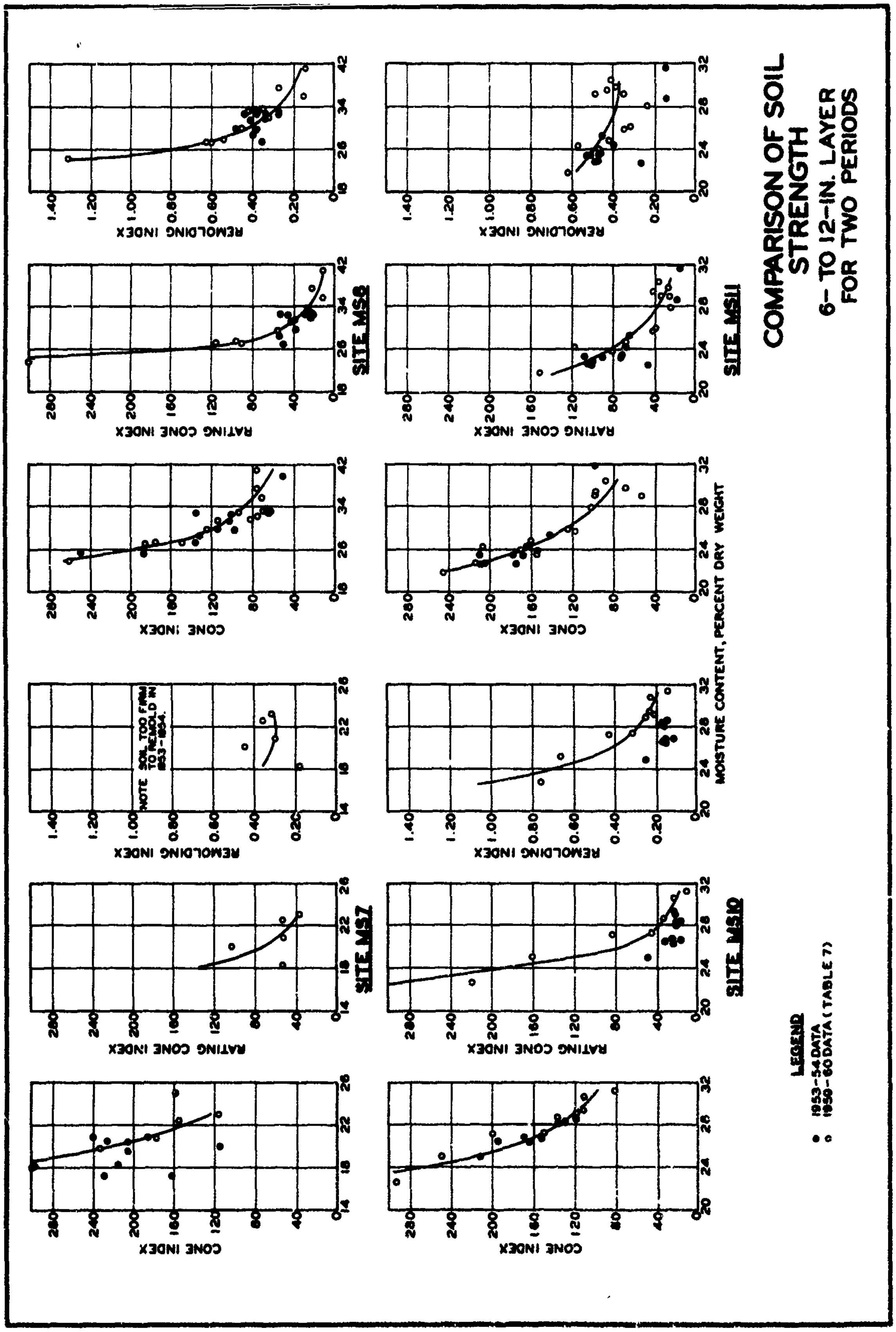
PLATE 18



SOIL MOISTURE-STRENGTH RELATIONS

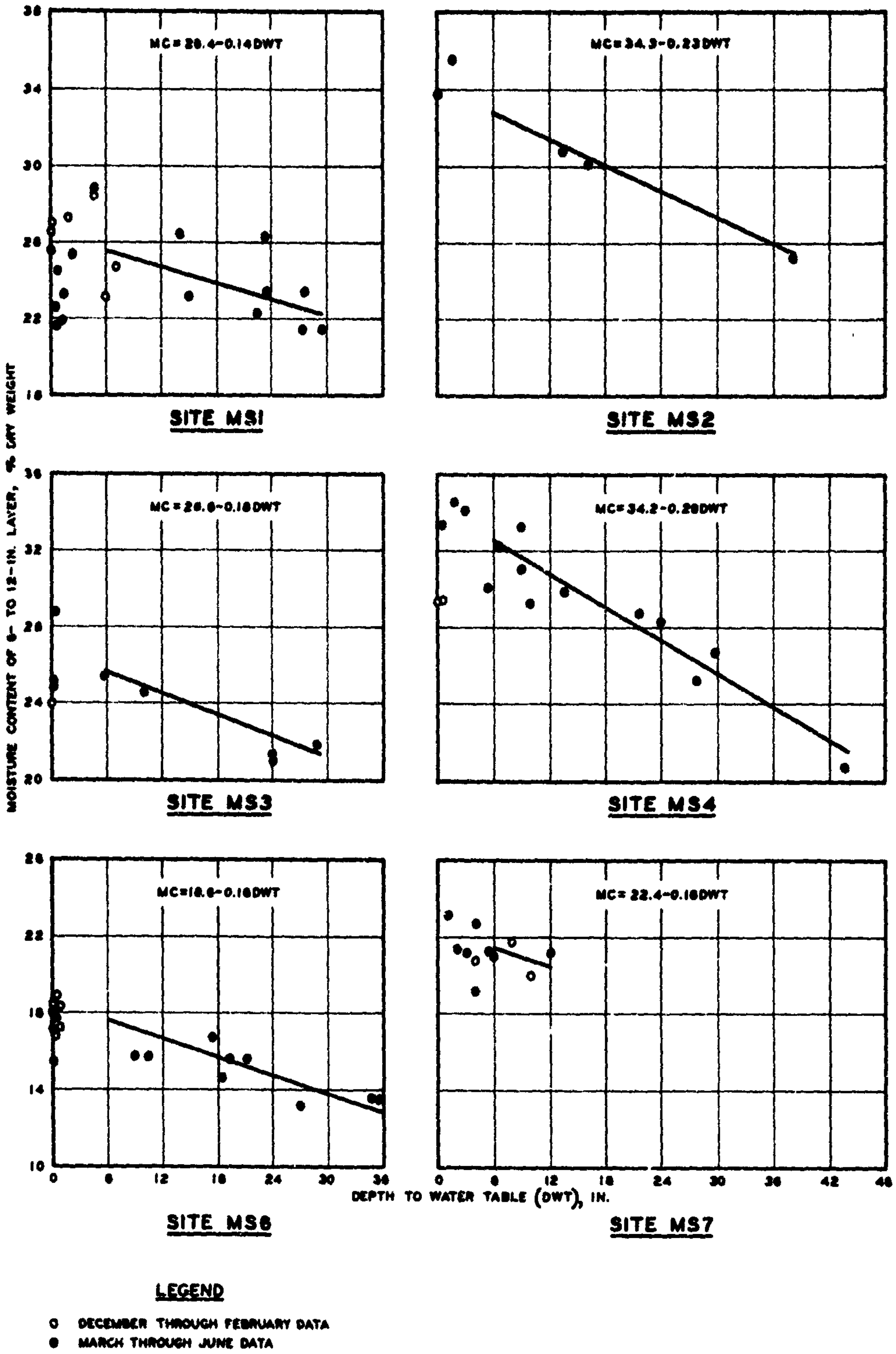
6- TO 12-IN. LAYER
SITES MS9-MS12

PLATE 19



COMPARISON OF SOIL STRENGTH
6- TO 12-IN. LAYER
FOR TWO PERIODS

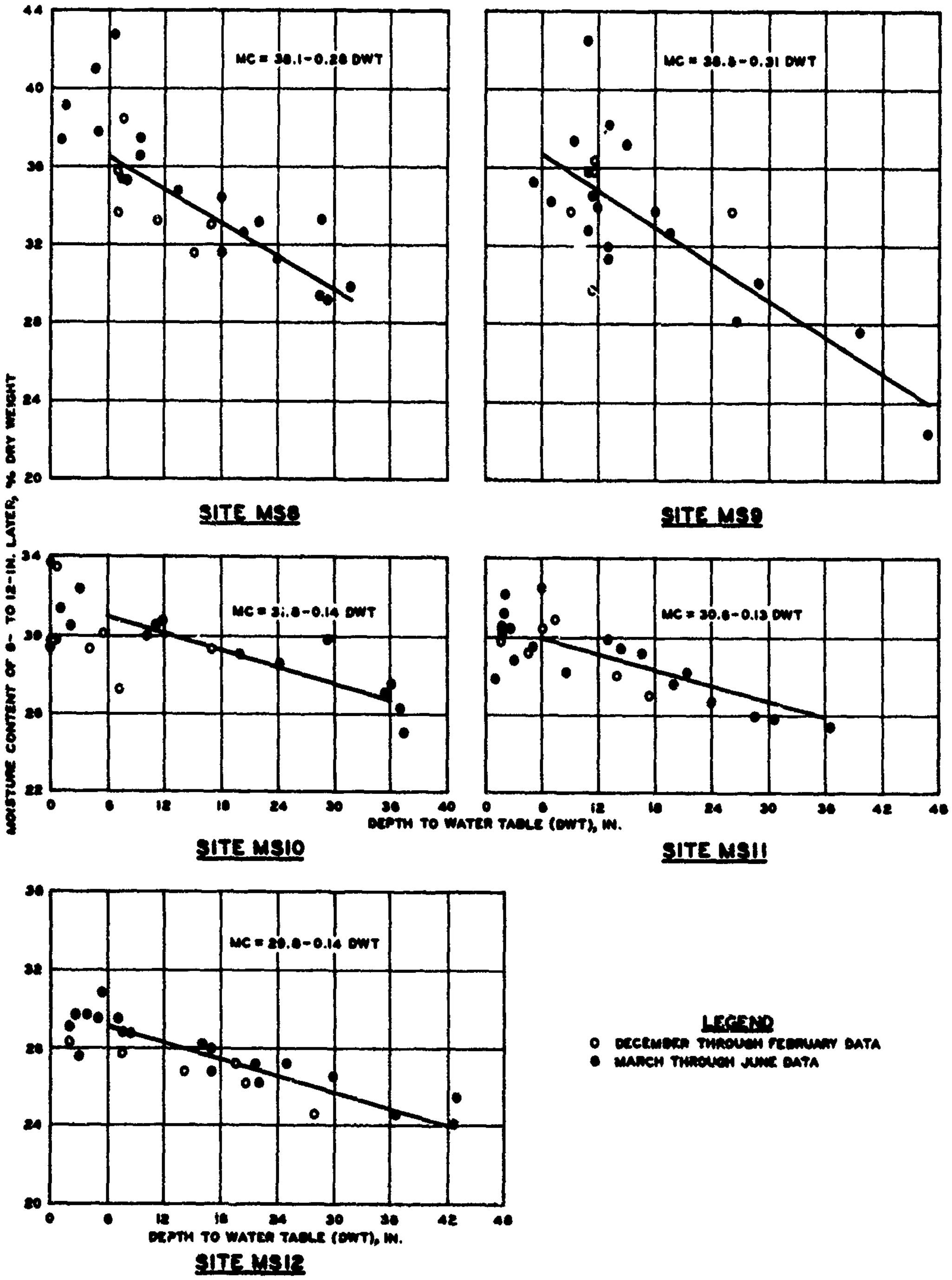
PLATE 20



SOIL MOISTURE CONTENT–DEPTH TO WATER TABLE RELATIONS

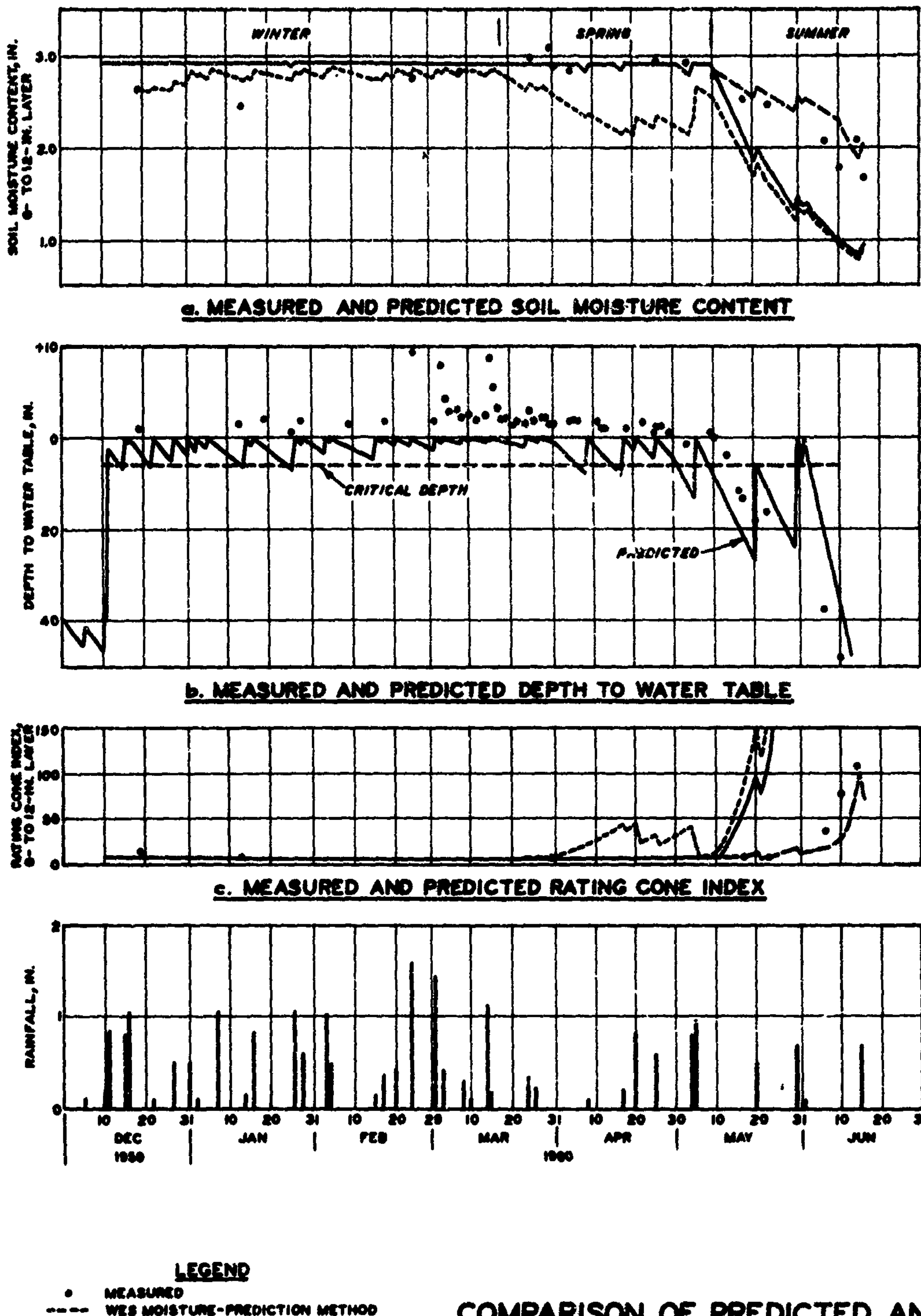
SITES MS1 - MS4, MS6, AND MS7

PLATE 21



SOIL MOISTURE CONTENT-
DEPTH TO
WATER TABLE RELATIONS
SITES MS8-MS12

PLATE 22



COMPARISON OF PREDICTED AND MEASURED WATER TABLES, MOISTURE CONTENTS, AND STRENGTHS

SITE MS2

PLATE 23

Unclassified

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

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5. AUTHOR(S) (First name, middle initial, last name)

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Marvin P. Meyer

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11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY U. S. Army Materiel Command Washington, D. C.

13. ABSTRACT

The purpose of the study was to determine and evaluate soil, site, and weather factors that affect high water tables, and to explore means by which an existing method for predicting soil-moisture content of the 0- to 6-in. and 6- to 12-in. layers could be modified to improve its accuracy when applied to soils with high water tables. Factors that significantly affected the initiation, duration, and periodicity of high water tables were precipitation, topographic position, depth to a relatively impermeable soil layer, slope of ground, rate of evapotranspiration, and, where applicable, stream or river stage. A scheme for predicting daily depths to water tables was incorporated in the soil-moisture prediction method, resulting in reasonably accurate predictions of soil moisture content and soil strength.

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14. KEY WORDS	LINK A		LINK B		LINK C	
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